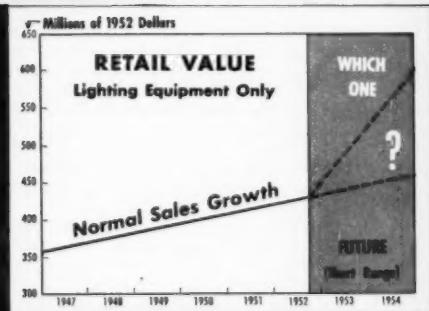


ELECTRICAL CONSTRUCTION AND MAINTENANCE





DRAW-OUT TYPE AIR CIRCUIT BREAKER pulls out for inspection—can be easily replaced with a spare if maintenance is required. Modern metal enclosed units with no exposed live parts provide maximum safety.

Order by number— save weeks on delivery

Look at the catalog, pick out the ratings for the number of feeders you require, and just order by number! That's all you have to do to get modern G-E low-voltage air circuit breaker equipment delivered in minimum time.

Cataloged standards give you pre-engineered, high quality equipment. And they are available for quick delivery because of the reduction of engineering and manufacturing time made possible by repetitive manufacture.

G-E Standardized Air Circuit Breaker Equipment

**600 volts maximum—interrupting
ratings 15,000 to 50,000 amps.**

Cataloged equipments offer a wide choice of arrangements. They are listed in groups, with various combinations of manually or electrically operated breakers—either with or without instrumentation. Each group number covers a complete switchgear unit, fully co-ordinated, factory-assembled and ready to install. Any number of units can be combined in one line-up to form a complete switchboard.

For full information, contact your nearest G-E apparatus sales office, agent, or distributor, or write to General Electric Company, Schenectady 5, New York.

HG&P 42

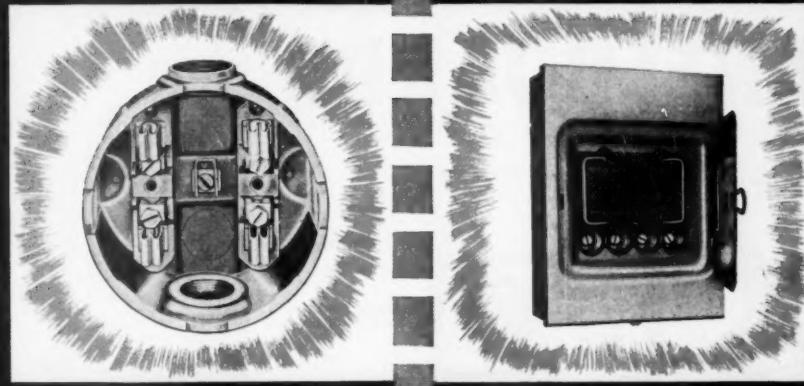


**"Cataloged Drawout
Air Circuit Breaker
Equipment"**

With this publication, you can order G-E air circuit breaker equipment by catalog number. Write for GEC-849.

GENERAL  ELECTRIC

They're Designed to MATCH



And Save you MONEY

Make the job easier and quicker by using Murray matched equipment. All elements of each unit are designed to go together. Take the Murray Meter Socket and the Murray "Main and Range" illustrated. Installation is easier and quicker because knock-outs are positioned just right. Wiring is simplified because lugs are similar on both units. In addition, once installed, Murray matched equipment looks better and more workmanlike than devices from two different manufacturers.

HERE'S PROOF THAT MURRAY MATCHED EQUIPMENT SAVES MONEY!

Levittown, Long Island (17,000 homes) is using Murray matched equipment to handle the load. Now, another large project is being developed — 16,000 homes at Levittown, Pennsylvania. Murray matched equipment is being used again!

Further proof of the advantages of matched equipment is at Fairless Hills, Pennsylvania — a project of 4000 homes. The Murray Meter Socket and the Murray "Main and Range" are back-to-back on a large percentage of these homes.

It comes down to this — Murray matched equipment saves time in installation — and time is money. Whether it's a huge project or a bungalow — matched equipment saves time and money.

One out of the 16,000 modern houses being built at Levittown, Pa. Murray Meter Socket is located on outside wall, rear. Murray "Main and Range," located in a utility closet, backs it up on the inside.



Electricians like Murray equipment because it's easy to install. There's always plenty of wiring room in Murray equipment!



MURRAY MANUFACTURING CORPORATION

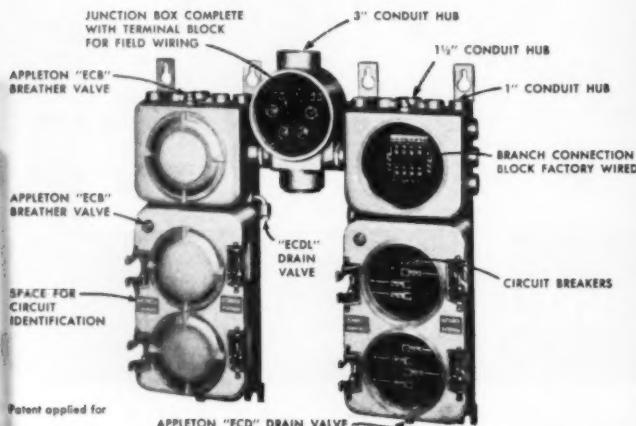
1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance & Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D) • Current Limiting Reactors • Crows'nest Aerial Ladders



For Greater Safety —Greater Convenience

Explosion-Proof and Dust-Tight PANELBOARDS



Simplified wiring . . . easy access for inspection or maintenance . . . solderless terminals . . . new locking switch handles . . . instant circuit identification—these are a few of many safety and convenience features in newly designed Appleton "ELP" Explosion-Proof and Dust-Tight Panelboards.

Unexcelled as safe, convenient control and distribution centers for lighting circuits or single phase motor circuits, Appleton Type "ELP" Panelboards are available in 4 to 16 circuit models—10, 20 or 30 ampere ratings. Write for complete catalog information.

APPLETON

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Sold Through Electrical Wholesalers

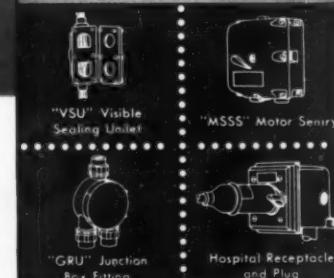
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APPLETON
Explosion-Proof
Fittings
for Every
Requirement



ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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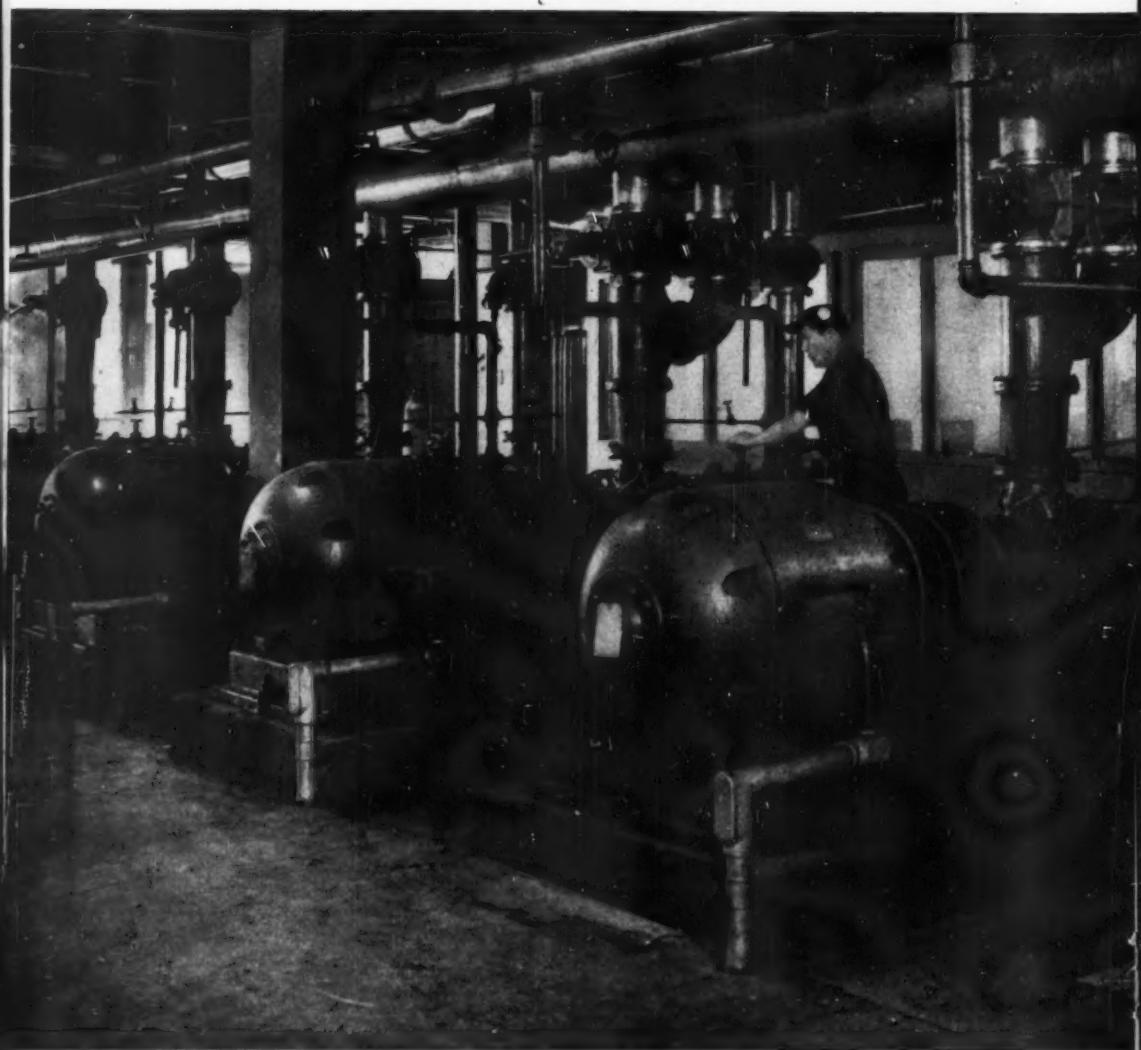
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INDUSTRY'S FIRST CHOICE



MASONITE CORP. is among the many big industrial users that prefer Tri-Clad motors for the hard jobs. In fact, 85% of the motors in Masonite's huge West Coast

plant are G-E motors. Shown above is part of a bank of 200-hp Tri-Clad motors which drive refiners that brush out the exploded wood chips used in making Masonite boards.

GENERAL  ELECTRIC

FOR THE HARD JOBS . . .

TRI/CLAD MOTORS

REG. U.S. PAT. OFF.

More than 10,000,000 horsepower of G-E Tri-Clad motors are now serving American industry. This is ample evidence that Tri-Clad motors are industry's first choice for the hard jobs—jobs where uninterrupted production is a must.

Here, for example, are reports from four more industries where G-E Tri-Clad motors are providing superior performance—with minimum maintenance—regardless of today's increasing production demands.

A MOTOR FOR EVERY NEED

In the Tri-Clad motor line, you have the widest selection of standard motors available today: ratings up to 2000 hp; all types of enclosures; gear motors, brake motors, and adjustable-speed drives—plus many other mechanical and electrical modifications to meet your requirements.

ENGINEERING HELP AVAILABLE

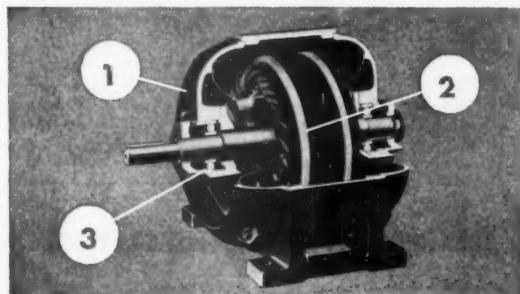
To get top performance from your machines, and to prevent costly shutdowns, G-E engineering specialists stand ready to help you plan your motor applications. And the most complete sales and service network in the motor industry assures you prompt attention to your motor problems.

PROMPT DELIVERY

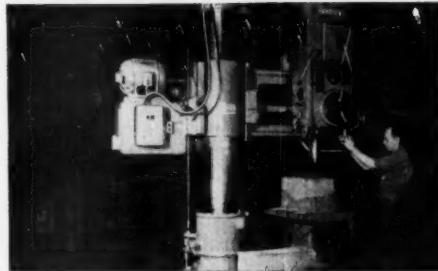
You can get standard G-E Tri-Clad motors right out of stock from G-E shipping points throughout the country. Contact your nearest G-E Sales Office or authorized G-E agent or distributor. *General Electric Co., Schenectady 5, N. Y.*

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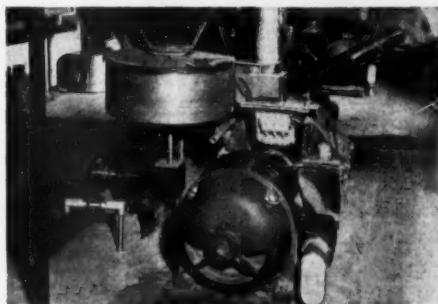
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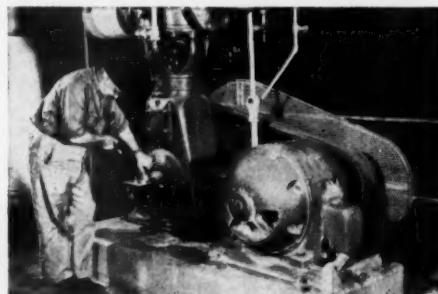
YOU GET TRIPLE PROTECTION with every Tri-Clad motor against physical damage, with rigid corrosion and blow-resistant cast-iron frame; electrical breakdown, with G-E Formex® wire which resists oil, heat, moisture, abrasion; wear and tear, with completely enclosed bearings that last longer because they can be relubricated if necessary.



BELL AIRCRAFT CO. uses Tri-Clad motors throughout its plant. The Tri-Clad motor on this heavy radial drill has operated continuously for many years. Plant personnel can't remember a single interruption due to Tri-Clad motor failure!



HERSHEY CHOCOLATE CO. relies on Tri-Clad motors for hard jobs where shutdowns would be extremely costly. This Tri-Clad motor drives a cocoa mill—in continuous operation.



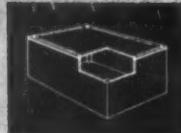
AMERICAN CRYSTAL SUGAR CO. reports complete satisfaction with G-E Tri-Clad motors on hard jobs. This Tri-Clad motor provides snappy starting ability needed by the compressor which supplies air to operating equipment throughout the plant, at Moorhead, Minn.

STANDARD

CUSTOM

...CAST BOXES* BY HOPE

STANDARD TYPES & SIZES

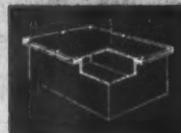


UNFLANGED BOXES

H1200 Type

164 sizes

from 4 x 2 x 2 to 48 x 36 x 17

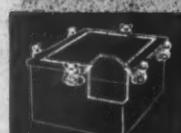


FLAT FLANGED BOXES

H8000 Type

87 sizes

from 4 x 4 x 3 to 36 x 36 x 12

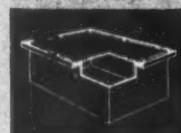


HINGED COVER BOXES

H3200 Type

129 sizes

from 5 x 5 x 3 to 36 x 36 x 12



FLANGED RECESSED COVER BOXES

H7000 Type

31 sizes

from 4 x 4 x 3 to 36 x 24 x 12



CHECKERED COVER SIDEWALK BOXES

H5800 Type

53 sizes

from 6 x 6 x 4 to 36 x 24 x 14

STANDARD BOXES are of strong, dense cast iron—hot dip galvanized for long service and attractive appearance. Weatherproof construction—rubber-gasketed closure prevents entry of rain, snow, sleet or dust under normal conditions.

HOPE

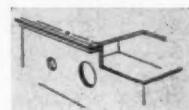
ELECTRICAL PRODUCTS CO., INC.

338 Wilson Avenue, Newark 5, N. J., Mitchell 2-4426.

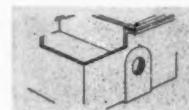
CUSTOM VARIATIONS

You can specify any of these modifications in standard BOXES by HOPE—have them factory-made at moderate cost—and get prompt delivery.

DRILLING—
or drilling and tapping—
of conduit entrances

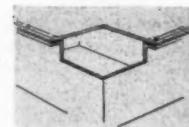


BOSSES—
to provide extra thickness
for five-thread conduit entrances.
Drilled and tapped to specification
if desired

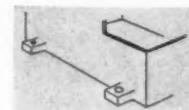


SPECIAL GASKETS—

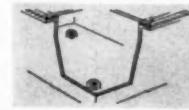
Neoprene for fungus resistance in hot,
humid climates • pure gum for extreme soft-
ness and resistance to special acids •
Vulmonoid for resistance to oils and fats •
graphite-free compressed asbestos
for installation near boilers or steam pipes



MOUNTING LUGS—
drilled for any desired
bolt size



INTERIOR MOUNTING BUTTONS—
—topped blind
to specified centers



AND . . . you can order these custom modifications, as well as
standard BOXES by HOPE, conveniently and quickly, through
your local electrical distributor.

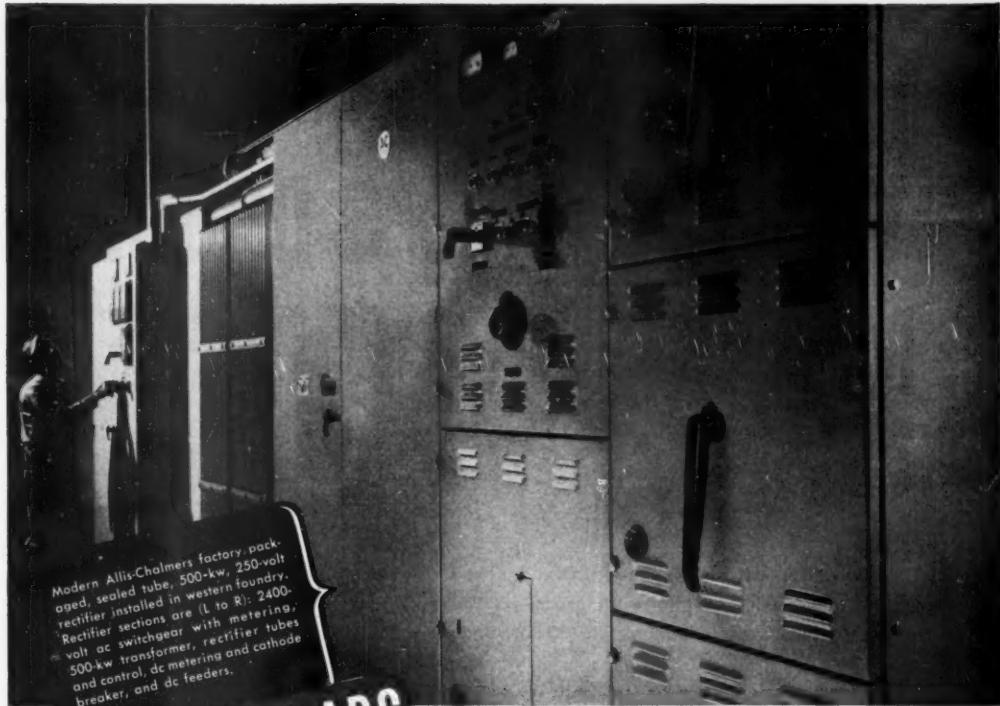
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HINGED CABINETS • TERMINAL BOXES • EXPLOSION HOUSINGS

EXPLOSION HOUSINGS BY HOPE

have been extensively used in Class 1, Groups C and D hazardous locations, such as chemical, petroleum and powder plants, pump rooms and paint plants.

GET THE FULL STORY ON BOXES BY HOPE —

WRITE ON COMPANY LETTERHEAD FOR CATALOG



Modern Allis-Chalmers factory packed, sealed tube, 500-kw, 250-volt rectifier installed in western foundry. Rectifier sections are (L to R): 2400-volt ac switchgear with metering, 500-kw transformer, rectifier tubes and control, dc metering and cathode breaker, and dc feeders.

MERCURY ARC RECTIFIERS

For Critical DC Service

Supply Power for Centrifugal Pipe Casting Machines at Western Foundry

PRODUCTION UNIFORMITY DEPENDS on accurately regulated dc supply at the U. S. Pipe & Foundry Company, Decoto, California.

Variable speed dc drives on the centrifugal pipe casting machines *must* start quickly and accelerate at a *controlled* rate to distribute the melt uniformly throughout the mold before it hardens. Reliability is also vital since dc powers not only the casting machines but also the cranes transporting the molten metal.

The Allis-Chalmers 500-kw sealed tube mercury arc rectifier seen here was recently installed to meet these critical requirements. This rectifier combines the good regulation and low maintenance characteristics of the mercury arc rectifier with the following *exclusive* A-C refinements:

• **Fixed excitation anode** that doesn't contact mercury and is independent of level, turbulence or impurities.

• **Continuous excitation** — pilot arc always present, eliminating need for continuous and synchronized re-ignition. Rectifier will ride through severe ac voltage disturbances.

• **Grid phase control** — in cleaner region near anode, where ion density is lowest.

• **Internal cooling system** — high heat transfer with seamless tube cooling coil located within the rectifier.

• **Arcover-free tube** — eliminates danger of arcing-over to tube by insulating entire arc path.

• **Enamelled anode seals** — multi-layer fused vitreous construction provides high strength, trouble-free seal.

Allis-Chalmers sealed tube rectifiers are supplied in ratings from 200 kw at 250 volts to 1000 kw at 600 volts. When planning a rectifier installation of *any* size, call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wis. A-3855

ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry



WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!

*To Build Your Reputation and Your Business—
Build With Top-Name Quality!*

When you specify "Habirshaw" wires and cables, you need never worry about customer acceptance or satisfaction. The reason is simple . . .

The name "Habirshaw" is an industry byword for *quality cable*—for the finest in

materials and workmanship. For many years Habirshaw dependability and ruggedness have been *proved in service* in every type and kind of installation.

Specify Phelps Dodge Copper Products to boost *your own* name and business.

SEE YOUR PHELPS DODGE DISTRIBUTOR



• **HABIRITE-HABIRPRENE** shielded, high-voltage primary cable is insulated with Butyl rubber, to insure dependable service.



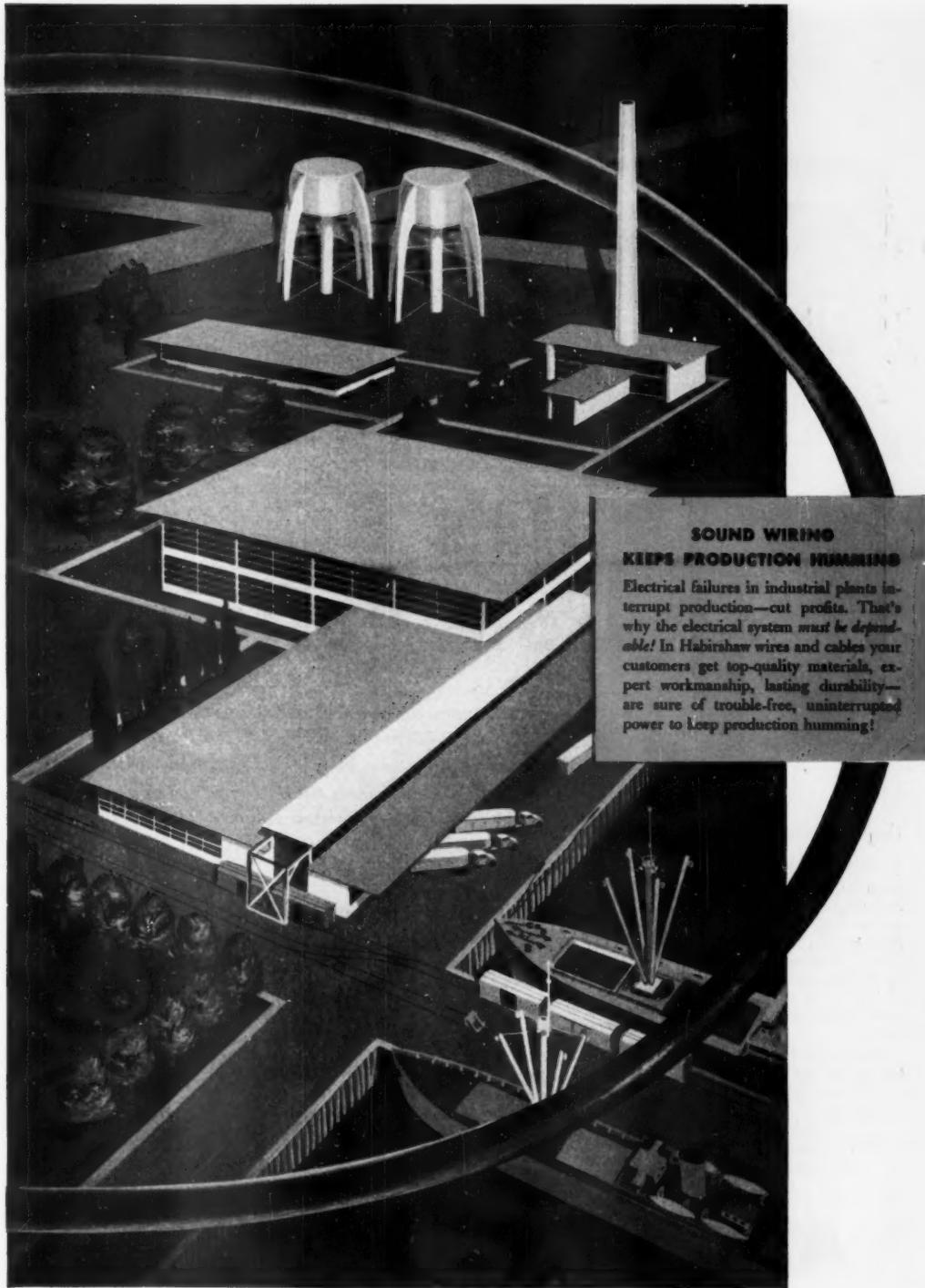
• **HABIRSHAW** heat-resistant, moisture-resistant, rubber-insulated, braid-covered cable insures reliability of feeder circuits.



• **HABIRDURE** small-diameter, moisture-resistant thermoplastic insulated wire is easy to handle and install in branch and control circuits.

PHELPS DODGE COPPER PRODUCTS CORPORATION



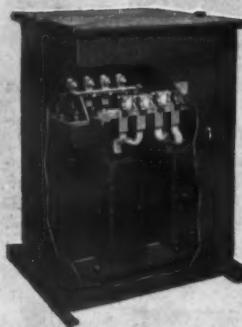


**SOUND WIRING
KEEPS PRODUCTION HUMMING**

Electrical failures in industrial plants interrupt production—cut profits. That's why the electrical system *must be dependable*! In Habirshaw wires and cables your customers get top-quality materials, expert workmanship, lasting durability—are sure of trouble-free, uninterrupted power to keep production humming!

ALLIS-CHALMERS

TRANSFORMERS



They're Endurance Built

Core and coil assembly is impregnated to guard against moisture and dirt. All-welded, modern-looking case protects the internal assembly. Case is Spra-Bonderized to protect it against corrosion. Three coats of baked-on alkyd resinous paint furnish additional protection.

Ratings 167 kva and smaller (single phase); 300 kva and smaller (three phase), 600 volts and below.



He's Boosting Low Voltages!

How? By installing an Allis-Chalmers dry-type transformer close to the load it serves. This will result in higher motor, lighting and thermal efficiency and safe, economical utilization of power for plant equipment.

Mounted on overhead trusses, these dry-type transformers free valuable floor space for production purposes. They can also be mounted on walls or columns. Vaults or expensive enclosures are not required.

Speed Installation

Allis-Chalmers dry-type transformers are easy to connect because junction boxes are eliminated. For connecting the conduits directly to the transformer case, knockouts are provided. System cables are connected to the transformer terminals in roomy compartments.

Easy to Maintain

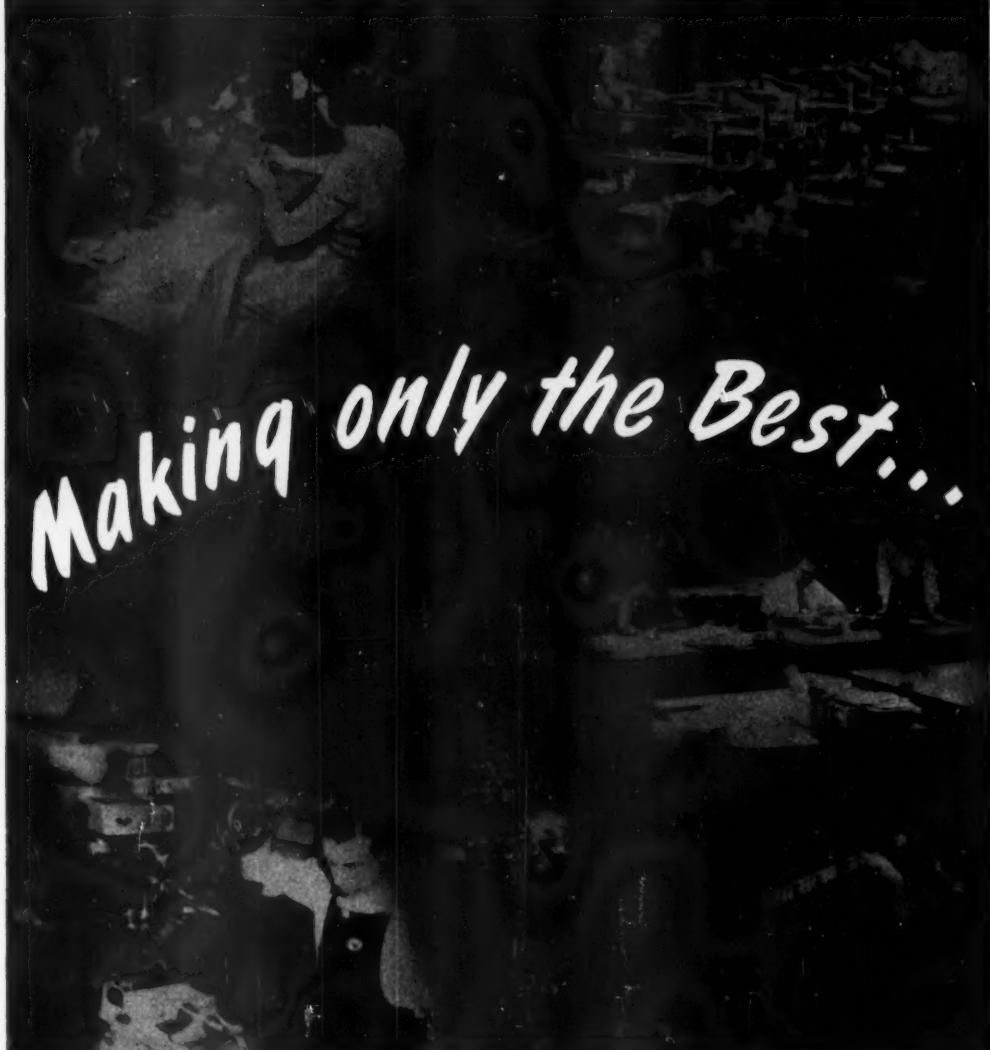
Install them and forget them except for periodic inspections. No insulating liquids to mess with; no gauges or gaskets to fuss with.

You can get more information about these Allis-Chalmers Class B insulated dry-type transformers from your Allis-Chalmers district office. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-3829

ALLIS-CHALMERS





Making only the Best...

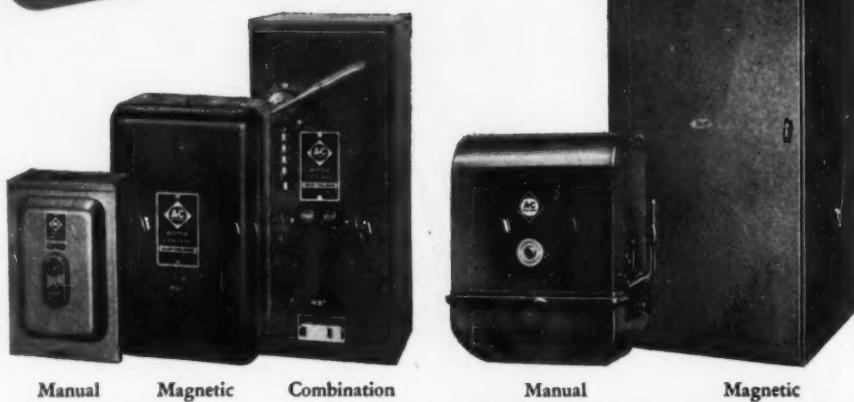
**Oil and Air Circuit Breakers • High and Low Voltage Switchgear
Unit Substations • Instruments • Precision Balances
Watthour Meters • Disconnect Switches • Outdoor
Hook Stick Switches • Air Break Switches
Indoor and Outdoor Bus Supports
Bus Ducts • Substations**



**ROLLER-SMITH
CORPORATION
AND ELPECO DIVISION**
BETHLEHEM, PENNSYLVANIA



110-550 VOL
MOTOR
STARTERS



ACROSS-THE-LINE STARTERS are easy to install and wire—compact enough to be installed on or near the controlled machine. Manual Starters in sizes 0 and 1, Magnetic in sizes 0-7 for motors from fractional to 600 hp. Combination in sizes 0-3. General Purpose and special enclosures to fit every need.

REDUCED-VOLTAGE STARTERS are used where the power system has insufficient capacity for full-voltage starting . . . to safeguard machinery or processes from high starting torque or current inrush. Choose from autotransformer, reactor and resistor types. Wide line available.

STARTERS for

Choose From This Wide Selection of Generously Designed Starters . . . Backed by Broad Application Experience in Every Industry

WHATEVER YOUR CONTROL NEED — starting, smooth acceleration, speed control, stopping, reversing, dynamic braking — there is an Allis-Chalmers starter to do the job. All are easy to install and have construction features that as-

sure long life, dependable operation, simplified inspection.

Low-Voltage Starters, Sizes 0-3 for example, have silver-to-silver double break contacts that never require dressing. A screwdriver is the only tool you need for inspection of magnet coils, heaters, contacts — all replaceable parts.

Sizes 4-7 have time-proven clapper-type contacts with rolling-wiping action to keep current carrying areas clean, free of pitting and arcing. Current is interrupted quickly and arcing minimized by chutes of new design. All electrical and mechanical parts are easily accessible.

High-Voltage Starters give you

everything needed for complete motor control and protection in a single enclosure. Contactors, meters, overload relays, auxiliary switches — all needed parts are selected to meet the requirements of your application. Enclosures are compartmented to isolate high-voltage devices. If you need the short circuit protection of current limiting fuses, specify Type H high-voltage starters.

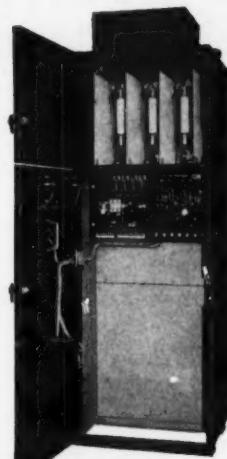
Remember, A-C application engineers have wide experience serving all industry. Their experience, plus this broad line of starters, is your assurance of the right starter for your job. Call your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.



2300-5000 Volt
MOTOR
STARTERS



Squirrel-Cage



Synchronous



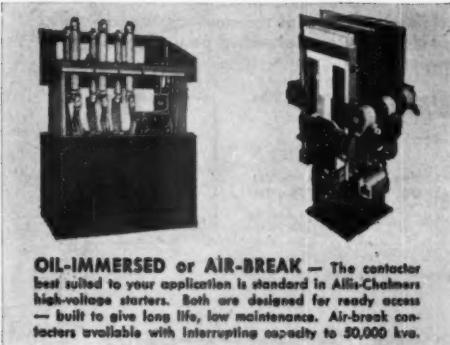
Wound-Rotor

THE TYPE 371 Wall-Mounted Starter for 2300-volt motors is completely sealed . . . protects the completely oil-immersed mechanism from weather, corrosion and dust. Wall mounting saves space.

ALLIS-CHALMERS Synchronous Motor Starters apply field excitation automatically when proper speed is reached . . . even select the exact half cycle for smoothest field application.

WOUND-ROTOR Motor Control for either starting or speed control duty, is built with the number of accelerating points your application requires. High-Voltage Starters are built for motors to 2500 hp.

Every Motor Need!



OIL-IMMersed or AIR-BREAK — The contactor best suited to your application is standard in Allis-Chalmers high-voltage starters. Both are designed for ready access — built to give long life, low maintenance. Air-break contactors available with interrupting capacity to 30,000 kva.

Allis-Chalmers, Milwaukee 1, Wisconsin

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Send me the bulletins indicated below:

- High-Voltage Starters - - - - - 1486410
- Type 371 Wall-Mounted Starter - - - - - 1487274
- Type 256 Air Contactor - - - - - 1487303
- Low-Voltage Across-the-Line Starters - - - - - 1487132
- Low-Voltage Reduced-Voltage Starter - - - - - 1487215
- Control Devices - - - - - 2587095

Name.....

Title..... Company.....

Address.....

City.....

State.....

A-3529

ALLIS-CHALMERS



KEY

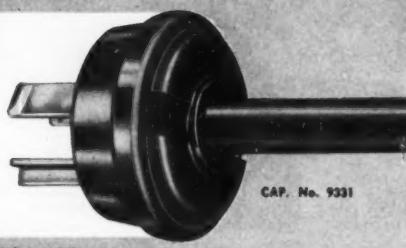
TO POSITIVE PROTECTION

NEW 3-WIRE
POLARIZED DEVICES
WITH

L-SHAPE GROUND CONNECTIONS

30 AMP. 250 VOLT

H & H



No. 9333
FLUSH RECEPTACLE
Brown Bakelite



No. 9332
CAP with CORD GRIP
Cord grip, .750"



ARMORED CAPS
No. 9337
Cap with adjustable cord
grip, .625" to 1.00"

No. 9338 (Not Shown)
Grounded cap with
adjustable cord grip,
.625" to 1.00"

FOR FACTORIES, REPAIR SHOPS, STORES, PUBLIC BUILDINGS,
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This design sets new standards of safety and protection in accordance with the 1951 Code by providing the correct, approved connection for all appliances and industrial equipment requiring 30 Ampere, 250 Volt service. The L-shape ground contacts and blades assure positive polarity and proper grounding at all times. Portable X-ray equipment, infra-red installations, kitchen equipment, clothes dryers, and other commercial laundry equipment are some of the many applications. L-Shape Devices will help build your reputation for jobs done better by providing positive protection for both personnel and hard-to-replace electrical equipment.

Write today for your free copy of our illustrated catalog. This handy aid to better wiring jobs fully describes our unusually complete line of wiring devices for every job requirement.

Address: 1710 Laurel Street, Hartford 6, Connecticut.

Branches in Boston, Chicago, Dallas, Denver, Detroit, Los Angeles, New York, Philadelphia, San Francisco, Syracuse. In Canada: Arrow-Hart & Hegeman (Canada) Ltd., Mt. Dennis, Toronto.



CALL YOUR NEARBY



ELECTRICAL DISTRIBUTOR FOR PROMPT SERVICE

WIRING DEVICES
ENCLOSED, SWITCHES

HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO.
HARTFORD 6, CONNECTICUT

Fluorescent Maintenance costs DIVE

when you use

Certified Starters

CERTIFIED STARTERS reduce your fluorescent lighting costs in two ways:

1. They assure full life for the lamps.
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CERTIFIED STARTERS thus cut your maintenance costs as well as increase your overall lighting satisfaction.

CERTIFIED STARTERS do this because they are made to precise specifications drawn up to meet the particular starting requirements of the fluorescent tube. They are then tested by Electrical Testing Laboratories, Inc., which certified they meet these rigid manufacturing specifications.

For Better Fluorescent Performance
and Lower Maintenance Costs
insist on CERTIFIED STARTERS.



Certified Fluorescent Starter Manufacturers

2116 KEITH BUILDING • CLEVELAND 15, OHIO

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . OCTOBER, 1952

90% Copper; hard drawn rod with forged spacer.

Machined from hard drawn aluminum.

SERVICE • CONNECTORS

Service Entrance Connectors; all sizes.

Approved by
UNDERWRITERS'
LABORATORIES

Service Post Connectors to meet A.Y. specifications.

Full line of aluminum connectors.

ALL TYPES and SIZES. Yoke-and-Nut Type, No. 10 to 1,000,000. Also Service Entrance, Service Post and Special Connectors (widest variety—more are shown below)

Penn-Union Service Connectors have accurate machine-cut threads, and carefully chamfered edges—do not catch in lineman's gloves.

Durable—re-usable over and over. Fully approved by Underwriters' Laboratories and the highest authorities in the utility field, for the most exacting service.

Penn-Union also makes the complete line of Tee Connectors, Cable Taps; Straight, Parallel, Elbow and Cross Connectors; Bus Supports, Clamps, Spacers; Ground Clamps, Terminal Lugs, etc., etc.

Leading users have found that "Penn-Union" on a fitting is their best guarantee of Dependability.

SOLD EXCLUSIVELY THROUGH WHOLESALERS

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

Canada: Dominion Cutout Company, Ltd.
250 Richmond St. West, Toronto

THE COMPLETE LINE OF CONDUCTOR FITTINGS

PENN-UNION

Chairs or Chocolates...



Crown Furniture Co. Skylike provides an easily-maintained, high-level incandescent lighting system for the Crown Furniture Company's new Detroit store. 100 foot candles were required to overcome the daylight pouring in both glass-walled ends of the showroom, yet individual area intensities may be modified for special effects by simply changing lamp sizes. Floor-level relamping with pole-type changers offers maintenance savings by eliminating the use of ladders or disturbing the floor displays.

SKYLIKE lighting shows off merchandise at its selling best.

Loft Candy Shops — As a part of its progressive modernization program, Loft has specified Skylike units as the primary light source in its stores. Experience showed that incandescent light presented its fine chocolates and other candies in the most appealing manner. Careful tests were made by Loft executives to assure them that Skylike's diffused radiation eliminated the heat problem at the display level. The view at left is of Loft's new White Plains store.

How SKYLIKE blends 2 types of Lighting Units into 1

SKYLIKE systems for stores are flexible and easy to plan. Modular 24" x 24" units can be recessed, semi-recessed, or surface mounted. They require low initial investment, too — cost only $\frac{1}{2}$ to $\frac{1}{3}$ as much as other equipment delivering comparable results.

Note these additional SKYLIKE advantages: high-maintained light output; softly diffused shadows; warm color values; instant starting; floor-service re-lamping; variable lamp size (150 to 500-watt).

Try SKYLIKE on your next lighting installation.



1. Soft, indirect light from silvered-bowl incandescent lamps...

2. The modern look of fluorescent-type troffers.

SEND FOR COMPLETE DETAILS

SKYLIKE LIGHTING, INC. — A Silvray-associated company
101 West Main Street, Bound Brook, New Jersey

Gentlemen:

Please send me further information on Skylike lighting.

Name _____

Firm _____

Address _____

City _____ Zone _____ State _____





Amazingly Simple— CIRCUIT BREAKER

SQUARE D's DESIGN LEADERSHIP IN ACTION!

Climaxing nearly twenty years' design leadership in the residential circuit breaker field, SQUARE D now offers this new and remarkably simple type of mechanism. Study the sectional illustration below—see how simplicity of design (only 3 moving parts) provides accurate, positive operation! See how this same simplicity gives you every worthwhile operating characteristic you want in a circuit breaker—without cost penalty!

**QUICK-MAKE,
QUICK-BREAK**
at no extra cost and
without the use of coil
springs. The spring
shown merely positions
handle—has no function
in breaker operation.

**Positive
Operation**
insured by action of
handle can directly
against contact arm.
No spring coupling.

**AUTOMATIC
RE-LATCHING**
Trips to "OFF." Circuit
restored simply by mov-
ing handle to "ON."

Compact
15-20 ampere, single
pole units are only $\frac{1}{2}$ "
wide. 15-20-30-40-50
ampere, double-pole are
only $1\frac{1}{2}$ " wide, yet ac-
commodate the larger
wire sizes.

**AMBIENT
COMPENSATED**
at no extra cost. Addi-
tional bimetal automatic-
ally regulates opera-
tion to surrounding at-
mospheric conditions—
prevents needless
tripping.

**Thermal-
Magnetic**
2-way protec-
tion against
heavy over-
loads and short
circuits.

**SHOCK
RESISTANT**
Simplicity of design,
light weight moving
parts, and new type
spring loading—all com-
bine to make breaker
unusually resistant to vi-
bration or shock.

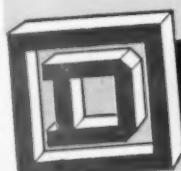
ACTUAL SIZE! Only $\frac{1}{2}$ " wide



**Plug-In
Mounting**
for easy, fast connection
to line bus. Steel rein-
forced, positive pres-
sure clip has been
perfomance-
proved on millions
of Square D
products.

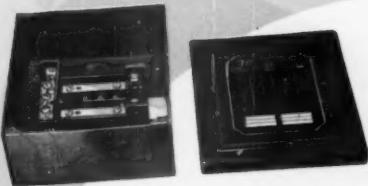
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SQUARE D COMPANY

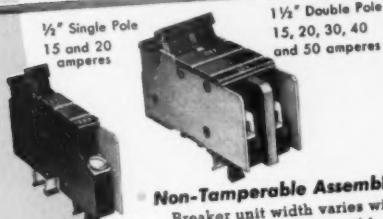


- yet All the Features! LOAD CENTERS

SO EASY TO STOCK, ASSEMBLE AND INSTALL . . .



- Only 3 components
(1) box and interior, (2) plug-in breaker units, (3) flush and surface covers.



- Non-Tamperable Assembly
Breaker unit width varies with capacity. Impossible to interchange high capacity ratings with smaller sizes.



- Easy to Install
Breaker units simply "plug-in" on bus bars. Load terminals out in front for easy wiring. Straight wire terminal connections—no looping.

- 1 to 32 Circuits
with lugs only and 1 to 20 circuits with main breakers—using only 6 basic boxes. General purpose and raintight.



WRITE FOR THE COMPLETE STORY... Today!



SQUARE D COMPANY, Dept. SA-13
6060 Rivard Street, Detroit 11, Michigan

Please send me my copy of
"The Biggest Circuit Breaker News in 20 Years"

Name

Company

Address

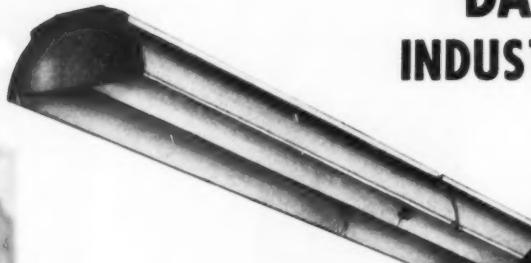
City

Title

Zone State

UPGRADING INDUSTRY'S LIGHTING STANDARDS

Wheeler "DAY-FLO UPLITER" INDUSTRIAL FIXTURE LINE



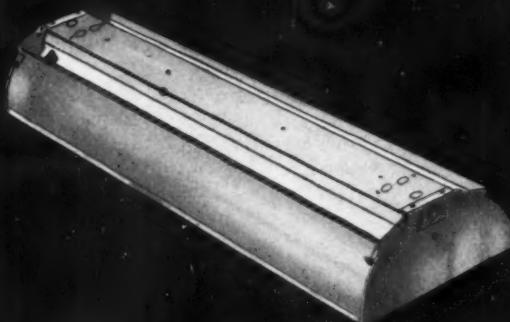
- 1 UNIQUE CONSTRUCTION — incorporating center V channel and deep shielding side reflectors — combined with continuous openings above the lamps permitting efficient upward distribution.
- 2 AIR-ACTION CLEANING — unique design permits a constant flow of air to circulate through fixture, thereby reducing dust accumulation.
- 3 EASY MAINTENANCE — all reflecting surfaces easily cleaned in position, or removable without tools when desired.
- 4 INDIVIDUAL OR CONTINUOUS MOUNTING — quick and easy mounting methods adaptable to any type of installation. Provision for sliding clamp hangers, conduit stems or chain hangers.



Wheeler

Distributed Exclusively Through Electrical Wholesalers
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REPRESENTATIVES IN PRINCIPAL CITIES

Superior distribution
ratios—Upward and Downward
—Plus better shielding!!



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is part of
the product,**

you're right with a
DELCO

When you need motors—to serve as a *part* of your product or to help you *make* your product—look to Delco for the motors that will serve you best.

Delco produces motors for practically every known purpose . . . and each Delco motor is *engineered* for the kind of work it has to do. It's made of the finest materials, and constructed to stand up longer under the roughest conditions.

So check on Delco. You'll find Delco motors fit your needs, and that Delco always delivers on time. For complete details, write to Delco Products, Dayton, Ohio, or call the nearest sales office listed below.

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Dayton, Ohio

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TOTALLY ENCLOSED FAN-COOLED MOTOR



OPEN BALL-BEARING MOTOR



TOTALLY ENCLOSED MOTOR



EXPLOSION-PROOF MOTOR

**DELCO FEATURES
MAKE
DELCO FINEST**

MINNEAPOLIS
Sept. 29, through Oct. 1.



MILWAUKEE
Oct. 7, through Oct. 10.

"BRINGING the mountain to Mohomet might best describe Dow Corning Corp.'s traveling exhibit... Free standing panels... separate the exhibit into nine bays, each emphasizing a property of silicones and showing where that property brings a benefit to an actual end product or operating unit..."

INDUSTRIAL MARKETING (June 1952)

*Coming
to help you*

solve problems in design
and production!



"NEXT TO THE GREATEST SHOW ON EARTH... We could go on... reciting the fantastic properties of Silicones, but just as breathtaking as the materials were the display techniques used to demonstrate them..."

CIRCUIT RIDER (Vol. 6, No. 2, published by
Electrical Construction and Maintenance)



"...Heat Stability Plus: Visitors... see, among other demonstrations, how Silastic (Dow Corning's silicone rubber) remains soft and flexible at temperatures far above the limits of organic rubber..."

CHEMICAL WEEK (Jan. 26, 1952)

ST. LOUIS
Sept. 23, through Sept. 26.



"IF YOU HAVEN'T already seen it, don't miss it when it comes around..."

POWER ENGINEERING (May 1952)

*In Boston • Chicago • Cleveland • Dayton
Detroit • Fort Worth • Houston
Indianapolis • Los Angeles • New York
Philadelphia • Pittsburgh • Seattle
Washington, D.C. • or Wichita.

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MAIL THIS COUPON TODAY

Dow Corning Corporation, Dept. G-22
Midland, Michigan

Kindly include me among your guests at the
private showing of the Dow Corning Silicone
Exposition in

<input type="checkbox"/> St. Louis	<input type="checkbox"/> Buffalo
<input type="checkbox"/> Minneapolis	<input type="checkbox"/> Newark
<input type="checkbox"/> Milwaukee	<input type="checkbox"/> New Haven
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Winston-Salem

NAME _____

ADDRESS _____

CITY _____

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Chicago
Cleveland
Dallas
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**DOW CORNING
SILICONES**

CORPORATION
MIDLAND, MICHIGAN

CANADA: Fiberglas Canada Ltd., 1200 Bay St., Toronto, Ontario
ENGLAND: Midland Silicones Ltd., 49 Park Lane, London, W.I.

BUFFALO
Oct. 29, through Oct. 31.

NEW HAVEN
Nov. 11, through Nov. 13.

BALTIMORE
Nov. 18, through Nov. 20.

NEWARK
Nov. 4, through Nov. 7.

CINCINNATI
Oct. 21, through Oct. 23.

WINSTON-SALEM
Dec. 9, through Dec. 11.



DOW CORNING SILICONES

...are no longer a mystery or a "future possibility" to the 17,000 executives and engineers, representing more than 4600 plants, who have already seen the Dow Corning Silicone Exposition.*

They learned that silicones are fluids and resins that keep clothes and shoes and brick walls dry in the rain. They're fluids that polish without rubbing.

They're rubber that won't melt on hot aircraft engine cylinders or freeze on switches that operate bomb bay doors at 100° below zero.

They're electrical insulating resins and varnishes that double the power of electric motors, or multiply by 10 the life of electric machines.

They're paints that protect metal at 1000° F.

They're foam killers and release agents.

They're a whole family of new engineering materials that can help you to improve your product or to cut production costs.

Give your clients real circuit protection...

INSTALL AB-I CIRCUIT BREAKERS

Customers know Westinghouse AB-I Circuit Breakers offer outstanding circuit protection for today's needs, for tomorrow's expanding power demands.

Users save because service is restored in seconds after a fault is cleared. Anyone can safely turn the handle to "Reset" and back to "On". If the fault continues, the breaker merely trips again. Downtime is minimized, workmen aren't exposed to "live" parts.

In contrast to other types of circuit-protective devices, AB-I Circuit Breakers require no replacement elements.

On shorts and dangerous overloads, AB-I Breakers trip instantly. Harmless overloads and peaks are carried without circuit interruption. Calibration stays exact and tamper proof for the life of the installation. Trip-free AB-I Breakers cannot be held or locked "On" against a fault.

Easy-to-install AB-I Breakers are available for almost every NEMA application. Call your Westinghouse Distributor or write for B-5456, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-30094



YOU CAN BE **SURE**...IF IT'S
Westinghouse
AB-I Circuit Breakers
THE COMPLETE LINE

"Of course, circuit breakers save money."

ALECTRAL

ALUMINUM SERVICE DRO

Load for load ALECTRAL aluminum service-drop and entrance cable is lighter, easier to handle, more readily available and...is less costly than copper. The same is true of certain other aluminum types such as TIP-TOP® weatherproof (illustrated) and aerial power cables. The men who are responsible for specifying conductor materials have come to recognize these advantages now more than ever before.

Perhaps, today, you are confronted with a problem that ALECTRAL Aluminum conductors could completely solve. General Cable Corporation is the largest manufacturer of insulated aluminum wires and cables and is the pioneer in this field. Contact your nearest General Cable office for complete information on ALECTRAL aluminum wire and cable.

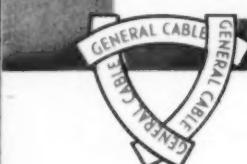
GENERAL CABLE
CORPORATION

EXECUTIVE OFFICES: 420 LEXINGTON AVE., NEW YORK 17, N.Y. • SALES OFFICES IN PRINCIPAL CITIES OF THE U.S.

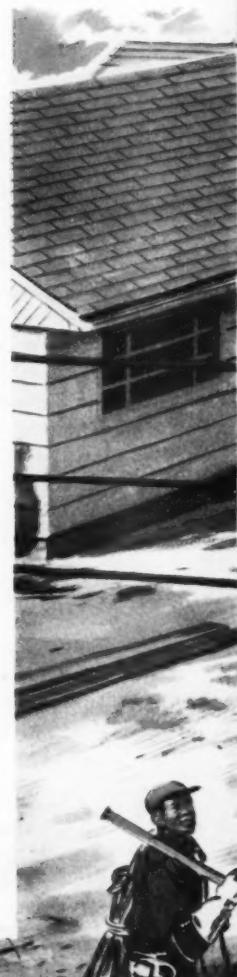
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CHECK THESE IMPORTANT ADVANTAGES OF ALUMINUM SELF-SUPPORTING AERIAL POWER CABLES

- ✓ **SIMPLIFIED INSTALLATION**
permits lighter fittings and longer spans.
- ✓ **REDUCED TREE TRIMMING EXPENSE**
Maintenance costs are lowered and highway beauty preserved.
- ✓ **GREATER SAFETY**
Withstands heavier ice and wind loads.
- ✓ **CLOSER VOLTAGE REGULATION**
permitted by lower reactance of cables than is normal with open-wire construction.



PIONEERS IN ALUMINUM



TRAIL[®]

P AND ENTRANCE CABLE



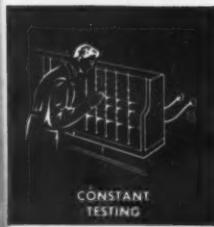
SUPERSHEATH-N FOR UNDERGROUND ENTRANCES

- INSTALLS DIRECTLY IN EARTH
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"More Power to You"[®]

INUM WIRE AND CABLE

P & S WIRING DEVICES



To be sure
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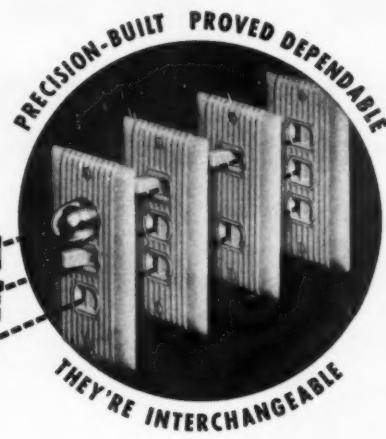
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WIRE THE P&S. DESPARD WAY...

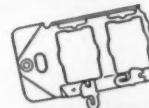
with the most modern,
the smartest-appearing
wiring devices on the
market today . . .

Here's How You Benefit

- Combinations of two or three compact, "specification" type P&S-Despard devices can be assembled under a single gang wall plate. You save on boxes — and on multi-gang wall plates.
- Practically any desired combination can be made up right on the job from a small stock of standard catalog numbers — no long waits for special combinations or special plates.
- P&S-Despard interchangeability makes it possible to give prompt service with a relatively small inventory — quicker turnover of your investment.
- The P&S-Despard Line gives you something to SELL — not just switches and outlets — but smart-appearing, compact combinations — modern, adequate wiring that looks good and is good.
- The P&S-Despard Line is not cheap — BUT IT IS ECONOMICAL. You can install quality, "specification" type devices — T-rated switches, double grip outlets — for only a few cents more, due to the savings on boxes and wall plates. Where low cost is the prime consideration, use residential type switches (1391 Line). You'll find a one-gang installation of two 1391 switches will cost less than a two-gang installation using competitively priced strap type switches — and you'll have a better looking job.



Assemble combinations
quick-as-a-flash with the
new Camstrap



Write Dept. M. for
complete information.

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the P&S-Despard Way?

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TIME-TESTED
DEPENDABILITY

PASS & SEYMOUR, INC.

SOLVAY STATION

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THE BEST COSTS LESS in the long run

PITTSBURGH STANDARD



ETNA, PA. (Pittsburgh) PLANT—1905

MORE CONDUIT, in the uncompromisingly perfect quality of Pittsburgh Standard, is on the way as we increase our productive capacity with our new plant facilities adjacent to the Fairless Works, Morrisville, Pa. The same guarantee of 100% perfect conduit . . . in all types . . . will now be enhanced with our newer, more modern equipment. And . . . after 50 years of growth . . . we've changed our company name, from Enamelled Metals Company, to its accepted "brand name" . . . PITTSBURGH STANDARD CONDUIT CO.

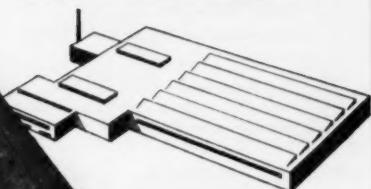
Now, more than ever . . . with even faster service to our huge nation-wide markets . . . PITTSBURGH STANDARD conduit will be "the standard of the trade."

Agents In All Principal Cities



We're Expanding

Proudly we build our
ultra-modern new plant
to supply you with
MORE QUALITY CONDUIT



MORRISVILLE, PA.
(Philadelphia) PLANT—1952

MORRISVILLE, PA.
(Philadelphia) PLANT—1952

Rigid Steel Conduit and E.M.T.

Electro-Galvanized
Black Enamaled
Hot Dip Galvanized
Elbows, Nipples, Couplings
Brigel E.M.T. Fittings



NEW

RYANT UNIVERSAL MOUNTING LAMPHOLDERS

New 5289-5290 line for
mounting on 3 $\frac{1}{4}$ and 4" boxes

Holes are provided in the base for use when mounting on 4" boxes. Removable knockouts permit mounting on 3 $\frac{1}{4}$ " boxes.

These new Bryant lampholders are ideal for bathroom use where the handy outlet provides a connection for electric shavers or heaters.

In basements, garages or other locations the convenience outlet may serve extension lights, portable tools and appliances.

The terminals of these new Bryant devices permit ready attachment of the conductors.

Both devices are rated —

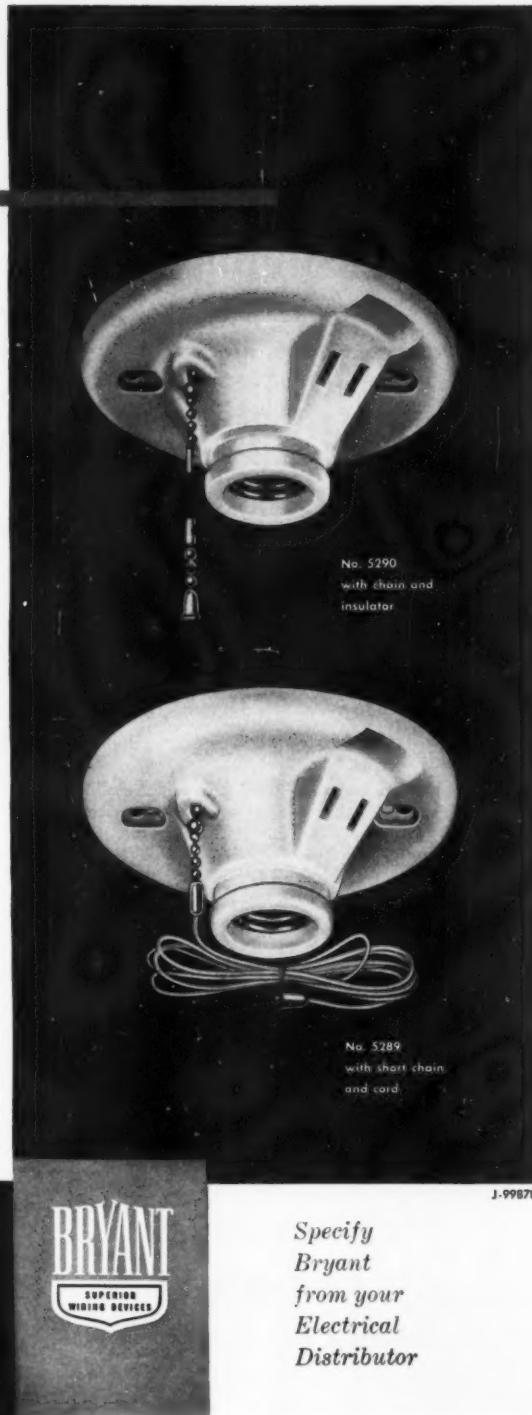
lampholder—250 Watts, 250 Volts
outlet —15 Amperes, 125 Volts
10 Amperes, 250 Volts

Listed as Standard by Underwriters' Laboratories, Inc.

THE BRYANT ELECTRIC COMPANY

BRIDGEPORT 2, CONNECTICUT

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J-99878

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Hundreds of kinds and types are available to meet many different power requirements . . . and these motors are available in 5 different types of frames to assure satisfactory performance in any kind of surrounding atmosphere. Choose from open type, drip proof, splash proof, totally enclosed fan cooled, and explosion proof frames.

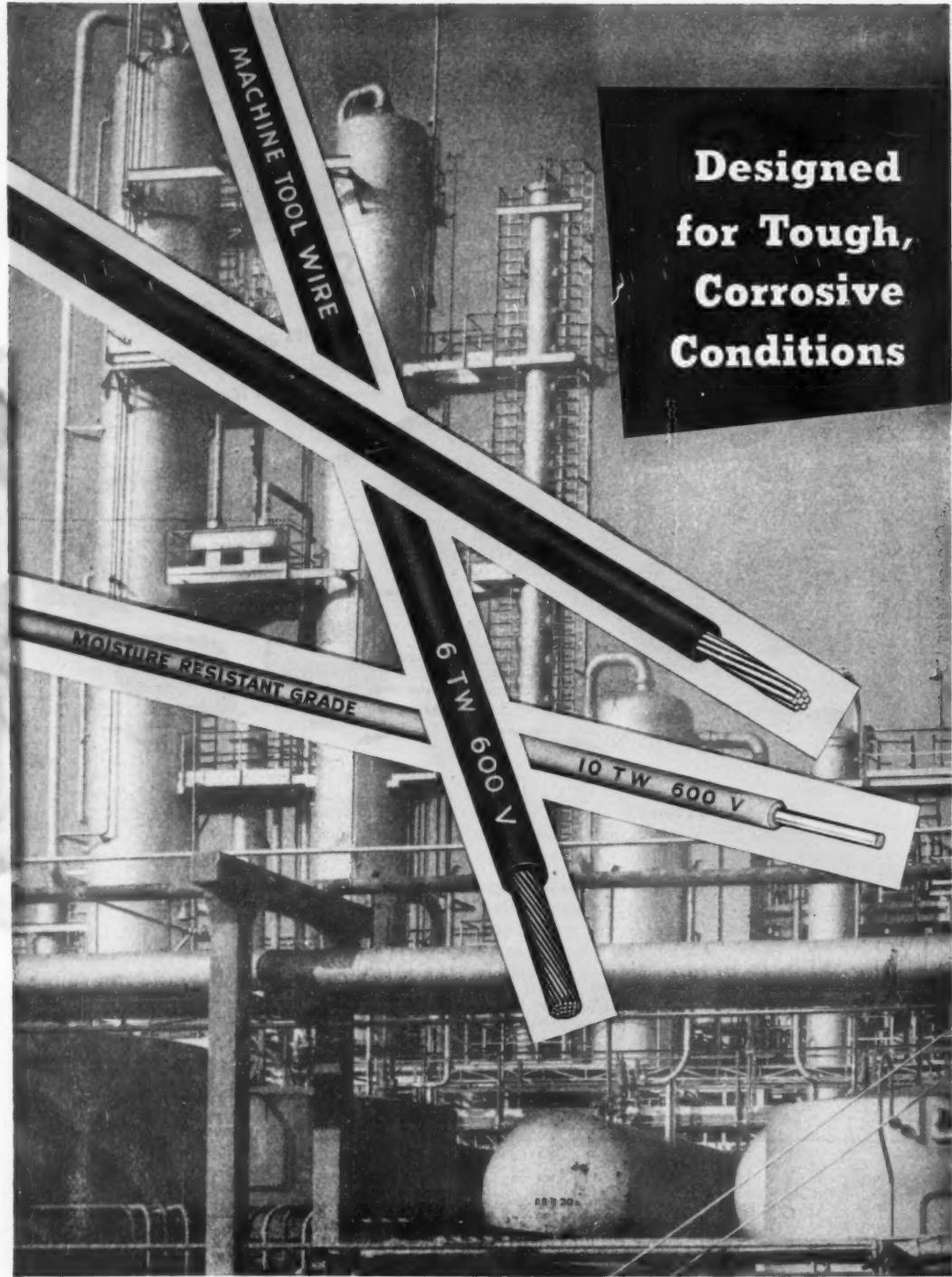
You can learn how to select the right motor with just a little help from a Century application engineer. He is anxious to help you get this kind of motor business. Write for more information

CENTURY ELECTRIC COMPANY

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ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . OCTOBER, 1952





**Designed
for Tough,
Corrosive
Conditions**

Rome Synthi^{ol}[®]

WIRES AND CABLES

Whenever you are selling or installing plant wiring, you'll find Rome Synthi^{ol} thermoplastic insulated wires and cables are sure to build your reputation for handling quality products. They are manufactured to withstand tough, corrosive conditions like those encountered in the chemical or petroleum industries.

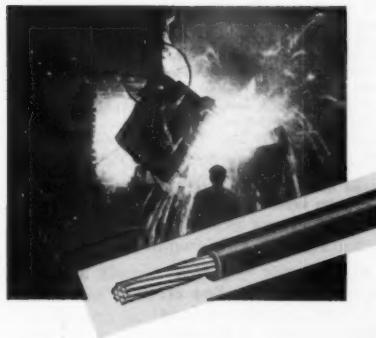
This rugged, polyvinyl chloride type insulation has proven its ability to resist acids, moisture, abrasions, corrosive fumes, flame, oils and cutting solutions. Colors remain permanently clear for quick, easy circuit identification.

What's more, Rome Synthi^{ol} assures quick, easy, economical installation. Its lubricated surface makes it easy to pull. It's easy to strip, too. And, its small diameter, high dielectric strength and excep-

tional aging characteristics make it ideal for industrial wiring circuits.

Rome Synthi^{ol} Type TW small diameter building wire is approved by the Underwriters' Laboratories for use in wet locations under the rules of the National Electrical Code.

Rome Synthi^{ol} Machine Tool and Control Wire has been adopted as standard wiring material by machine tool manufacturers for extreme durability and excellent resistance to heat, oils, acids, alkalies, common cutting solvents, etc. Underwriters' Laboratories approved as Type TW, with end use approval for 80° C. operation in air; 60° C. where exposed to oil and in wet locations. Conforms with National Machine Tool Builders' Assoc. Standards.



For Steel Mills, Chemical Plants, Oil Refineries and Other "Hot Spots" . . . Rome Synthi^{ol} 901
Here's the ideal insulation for the equipment wiring of steel mills, chemical plants, oil refineries and other "hot spots." A resin plasticized polyvinyl chloride type of insulation, Rome Synthi^{ol} 901 provides superior service life under high operating temperatures. It also offers high resistance to oils and chemicals. It is Underwriters approved for 600 volts at 90° C., when used as an appliance lead wire.

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ROME CABLE
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TORRANCE - CALIFORNIA



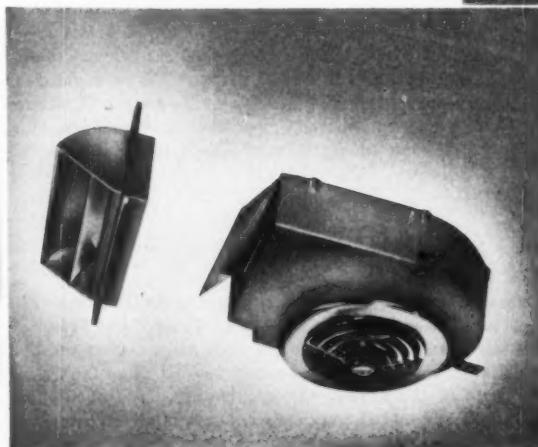
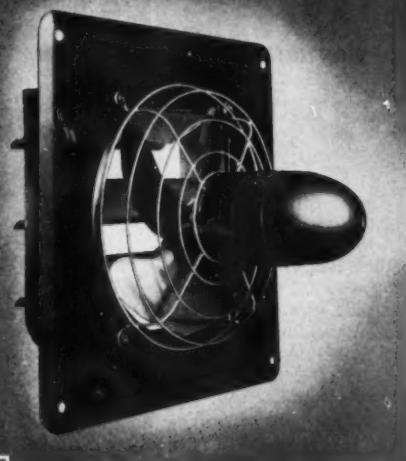
SIGNAL...

THE FANS WITH ADDED SALES APPEAL

Shutter-Attached Vent Fan Offers Single, Easy Installation!

SIGNAL's V-700 Series are compact, completely-assembled units; just fit into a wall-opening from the inside and attach!

- 8", 10", 12" and 16" models deliver 500, 700, 1200 and 1600 C.F.M. respectively.
- Enclosed, rubber-mounted induction motors with self-lubricating bronze bearings.
- 4-pole motors on all but 16" model, which has a 6-pole motor.
- Wide, deep-pitched 4-petal blade assemblies on all but 16" model, which has a 6-petal blade assembly.
- Gravity-type hooded shutters with replaceable aluminum vanes which operate in unison.
- Light but strong welded-steel frame permits use on thin-wall construction.
- 3-speed flush or surface mounted controllers available for more versatile operation.
- Attractively finished in durable hammered gray enamel.



Quality-Built Household Ceiling Or Wall Fan!

SIGNAL's attractive CW-100 solves home ventilation problems. Can be installed in either ceiling or side wall.

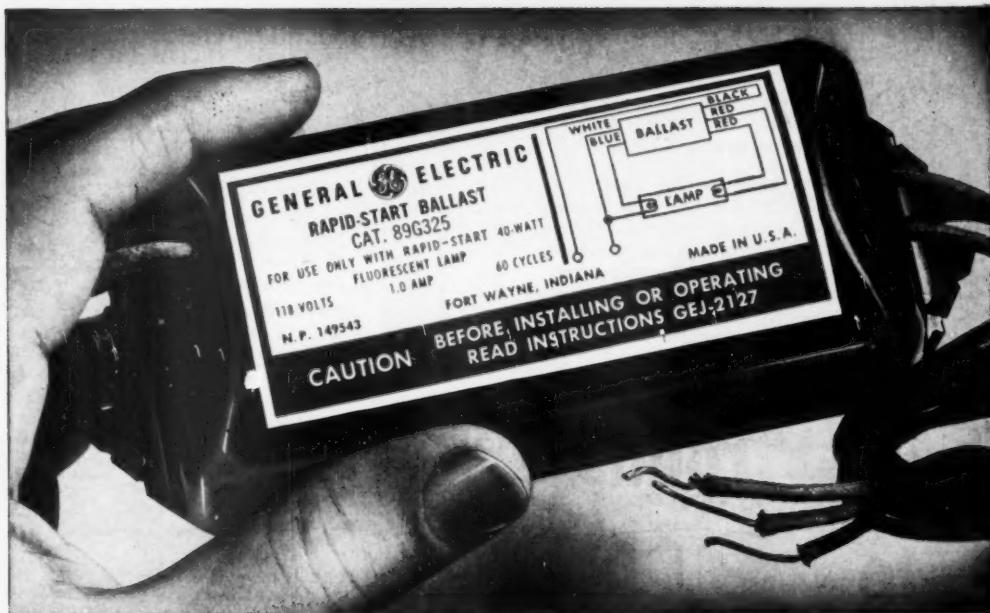
- 4-pole induction motor with oilless-type porous bronze bearings is totally enclosed and rubber-mounted.
- Blade is of centrifugal design to maintain high static pressure; moves 480 C.F.M. at 1520 R.P.M.
- Frame is of heavy cast aluminum; chromium plated grills easily removed without tools.
- One aluminum shutter vane in frame and another in weatherhead provide double backdraft protection.
- Weatherhead has a detachable 5" sleeve for use in brick wall construction.
- Over-all depth only 3½" . . . fits between 16" center joists or studs . . . accommodates standard 3½" x 10" furnace duct.
- 3-speed flush-type controller with chrome-plated face-plate is available.

Send today

for SIGNAL's new 1952 catalog featuring a complete line of:
Desk Fans • Floor Fans • Pedestal Fans • Window Fans • Exhaust Fans
Shutter-Attached Vent Fans • Kitchen Vent Fans • Electric Drills • Grinders
Fractional Horsepower Motors

SIGNAL

ELECTRIC MFG. COMPANY, MENOMINEE, MICHIGAN



THE GREEN LABEL DISTINGUISHES NEW G-E 40-WATT RAPID-START BALLAST FROM OTHER G-E BALLASTS—NOTE SIMPLIFIED CIRCUIT

New G-E Lighting Development

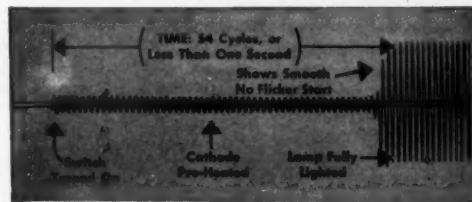
40-watt RAPID-START system eliminates starters

General Electric—first to introduce fluorescent lighting in 1938—now brings you a starterless system giving full, rated lamp life. New, electrically matched 40-watt RAPID-START lamps and ballasts do away with bothersome blinking at end of lamp life, give you eye-easy, no-flicker starts at a touch of the switch!

Present "instant-start" 40-watt fluorescent is costly, uses a heavier ballast—present "switch-start" is complicated by auxiliary starters and wiring—new RAPID-START system features smaller, lighter ballasts at a lighting cost comparable to 40-watt switch-start lighting.

General Electric lamp and ballast engineers have again combined their efforts to bring you a revolutionary development in 40-watt fluorescent lighting—the volume market. For new installations or to modernize old installations—a sales plus your customers will want! Act today. Contact your nearest G-E Apparatus Sales Office, or write Section 412-102, for complete information. General Electric Co., Schenectady 5, N. Y.

GENERAL ELECTRIC



ENGINEER'S ANALYSIS of oscilloscope readings shows fast, no-flicker pre-heated cathode action of new G-E Rapid-Start.



NEW G-E BIPIN LAMP, especially developed for fast, pre-heat starting, employs complex, triple-coiled cathode, right. Greatly magnified.



"LAY-IN" XTENSIONDUCT

For Wall or Ceiling Extensions

Here's the neatest thing in extensions for carrying wires along walls or ceilings. Eliminates difficult fishing through narrow channels. No ugly clips. Only the smooth, flat capping shows on finished work. No. 111 holds three No. 14 wires.



"LAY-IN" METAL MOLDING

For On-The-Surface Wiring

It's easy to install wiring with NE Metal Molding. Screw down the base, lay-in the wires, snap on the capping.

No. 333 is only 7/16" thick, yet holds eight No. 12 or nine No. 14 wires, or three No. 8 or six No. 10 wires (type TW).

No. 888 is 11/16" thick, holds ten No. 14, No. 12 or No. 10 wires.

5 easy roads to BETTER LIGHTING



OVAFLEX ABC

Not Armored Bushed Cable

Used for surface or concealed wiring. Only 7/16" thick. Can be installed and covered within plaster thickness. Bends flatwise and edgewise. There's a complete line of NE shallow Outlet and Switch Boxes and flat Connectors for Ovalflex.

WHEN new lighting requires extensions, changes or detours in wiring systems, here are 5 approved raceways to make the job easy. Designed to meet the most exacting architectural or industrial requirements . . . Quick and inexpensive to install. Complete interconnectable fittings to take care of every situation. Write for installation data.

SURFACEDUCT

The New Raceway for
Industrial and Commercial
Lighting

Another lay-in surface raceway (2-1/8" x 1-5/8" cross section) for use with all types of suspended lighting, cove, trough or window lighting. Banks of lights can be switch-controlled. Interconnectable with other systems. Unique bridge anchors capping and devices securely; serves as wire retainer when Surface-duct is mounted overhead.



OVALDUCT

Rigid Oval Steel Raceway

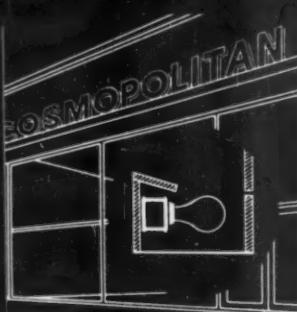
An "in-the-surface" raceway for concealed extensions from existing outlets. Only 13/32" thick. Easily installed within plaster thickness. Electro-galvanized for protection against rust. In addition, the inside is enameled for extra smooth fishing.

National Electric Products

PITTSBURGH, PA.

3 PLANTS • 7 WAREHOUSES • 42 SALES OFFICES





SURFACE DUCT Lighting Applications

For Rewiring
and Relighting
Adequately

Versatile NE Surface Duct offers the lighting engineer a 2-piece surface raceway unsurpassed for convenience, sturdiness, circuit roominess and accessibility. It is readily adapted to any kind of an installation or lighting fixture. May be used in either exposed or concealed locations. Unique bridge locks capping securely in place yet permits easy removal for future service additions.

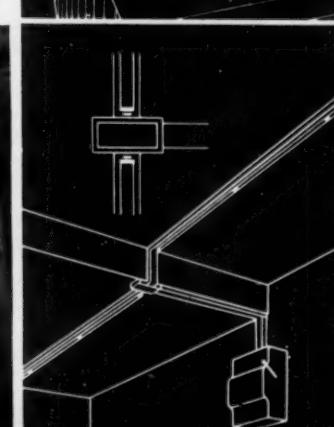
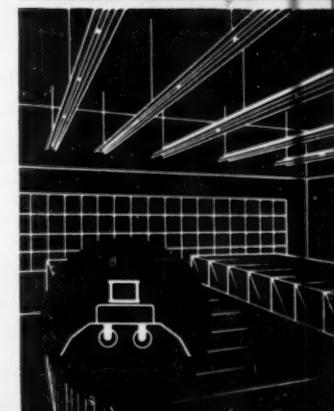
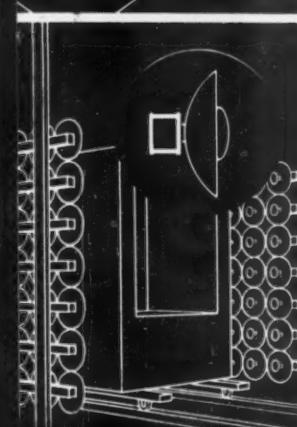
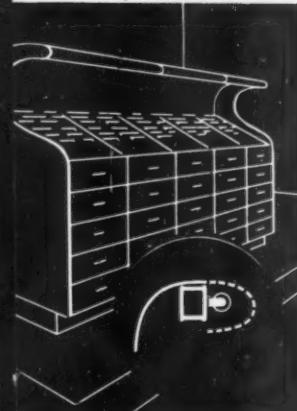
Eight device covers accommodate over 300 manufacturers devices. Twelve simple fittings meet all job requirements. Over-all dimensions: $1\frac{5}{8}'' \times 2\frac{1}{8}''$. Capacity with devices installed: Ten #10, #12 or #14 wires. Designed for loads up to 60 amp. Write for complete catalog.

*Leading electrical wholesalers
have stocks for immediate delivery.*

National Electric Products

PITTSBURGH, PA.

3 PLANTS • 7 WAREHOUSES • 42 SALES OFFICES



*...for service, quality,
true economy,
always specify...*

LEVITON

**wiring
devices**

... a complete line offering long-life, trouble-free performance, and price ranges to fit every job requirement.

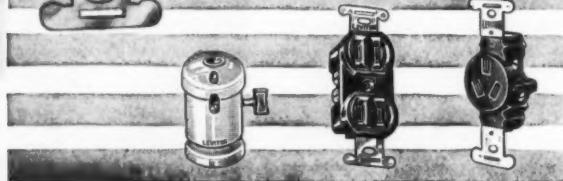
Leviton's vast selection makes standardization simple, too.

For residential, commercial, or farm installations leading architects and contractors specify

Leviton "tested" devices.



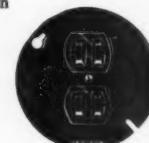
for industrial and commercial use



for residential use

combination devices of T-rated switches and receptacles... T-rated flush toggle switches... ceiling receptacles, porcelain or plastic, with or without outlets...

T-slotted, double contact, 2 and 3 wire receptacles, flush or mounted on covers... brass shell, plastic or porcelain pendant sockets and switches... cartridge and plug fuse cutouts... entrance switches
Lev-o-let surface installation devices for farm, factory, camp and cellar... flush and butt mounted fluorescent, slimline, and circline devices.



Send today for the new Leviton catalog - 96 pages of valuable wiring information and full descriptions on more than a thousand Leviton devices.

LEVITON MANUFACTURING COMPANY

main office: Brooklyn 22, New York • warehouses in: Chicago and Los Angeles

LEVITON

plants in: Brooklyn, New York • Hillsgrove, Rhode Island • Pawtucket, Rhode Island

Smithcraft AREA ILLUMINATION — CHALLENGE TO THE LIGHTING INDUSTRY

A challenge to sell and install the most beautiful lighting jobs you've ever seen . . . an invitation to excellent new profits because Smithcraft Area Illumination is without equal for ease and economy of installation.



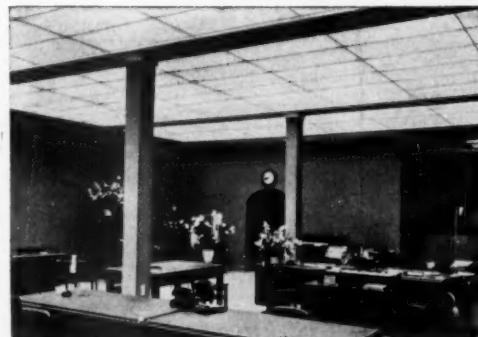
Once the hangers are in position on the ceiling, all you need is a level and a screwdriver. Everything falls in place quickly and easily with no careful dimensioning or critical locating of parts. Even the hangers are positioned almost haphazardly with an adjustment of 2" built right into the hangers. There's plenty of margin for error or for ceilings and walls that are not absolutely true.

There's a real satisfaction in installing a Smithcraft Area Illumination system . . . satisfaction in the way the job goes together . . . satisfaction in the finished appearance . . . and satisfaction in substantial profits for an outstanding lighting job well done. One good installation leads to another . . . and to more and more sales. Smithcraft Area Illumination is that good, both in its clean, trim, modern appearance and in its superlative glare-free, low-bright illumination.

If you don't know about Smithcraft Area Illumination, investigate now. We'll be glad to send you further information and any of the Smithcraft representatives throughout the country will be glad to tell you more about it.



D. C. Stafford of the Stafford Electric Company, Sanford, Florida writes: "I have just recently had the pleasure of installing Smithcraft Area Illumination in the Florida Power and Light Company's office in Sanford, Florida . . . not only one of the most beautiful lighting jobs I have ever seen, but the easiest to install. I do not believe it would be possible to install it wrong."



ARCHITECT: Elton J. Moughton, Sanford, Florida.

ELECTRICAL CONTRACTOR: D. C. Stafford, Stafford Electric Co., Sanford, Florida.

America's finest fluorescent fixtures **Smithcraft**

LIGHTING DIVISION
ELGIN CO., ILLINOIS



TRANSFORMERS FOR POWER TO MANUFACTURE JETS. While power house is built, locations are marked for the two 750-kva transformers shown in background. The double-ended load center,

ready for installation here, will serve auxiliary loads for Packard's new jet engine plant in Utica, Mich. Plant also contains six G-E load-center unit substations installed in three groups.

Load-center units speed building



G-E HIGH-VOLTAGE LIGHTING gives Packard adequate lighting with maximum flexibility and savings in copper and equipment costs



READY FOR JETS. When completed, Packard test cell will look like this—test J-47 jet engines built for U.S. Air Force.



LAYOUT FOR SECONDARY SELECTIVE SYSTEM. A 1500-kva double-ended load center, being installed, is typical arrangement for secondary selective distribution at Packard. Each transformer is

750 kva. High voltage is 4800 volts. Load center functions like two substations built into one, with tie circuit breaker between the two buses. Low voltage is 480Y neutral grounded.

of Packard's new jet engine plant

Secondary selective system with 480Y-v grounded neutral assures low-cost power continuity

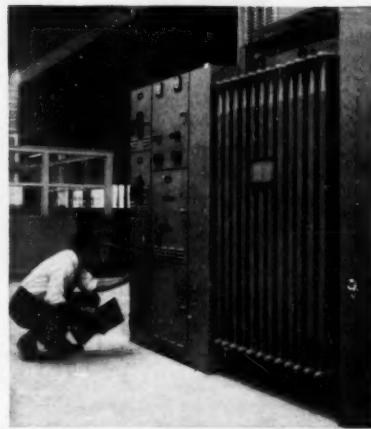
By using pre-assembled G-E load-center unit substations, Packard Motor Company was able to get a fast, inexpensive installation job on the power distribution system at its new jet engine plant in Utica, Mich.

Location of six load-center substations, arranged in pairs of three 1500-kva double-ended load centers, kept pace with construction of the plant bays themselves. A double-ended load center for auxiliary loads went into the power house even before it was completed.

The secondary selective distribution system chosen by Packard assures extreme reliability through its low-cost emergency tie, providing an alternate power source for the load area should either transformer go out. This system also saves cable, reduces operating hazards through low-voltage transfer switching, and permits removal of feeder, transformer, or main secondary breaker for maintenance without dropping service on either low-voltage bus.

For further information on G-E engineered load-center unit substations, call your local General Electric sales representative, or write for GEA-3592, General Electric Company, Schenectady 5, New York.

521-68



SIMPLE INSPECTION. G-E Type AK-1 breaker for low-voltage side pulls out easily for inspection. Big AL-2 breaker is to right center of others.

GENERAL  **ELECTRIC**

B-M *Fittings*

ARE APPROVED AS
CONCRETE-TIGHT



When setting E. M. T. in concrete you can make each job easier and more profitable by using Briegele All Steel Indenter Fittings that have UL approval as CONCRETE-TIGHT. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegele Fittings are the most widely used E. M. T. connectors and couplings.



Cross Section
Showing
Indentations.



BRIEGEL
METHOD
TOOL
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GALVA, • ILLINOIS

Distributed by

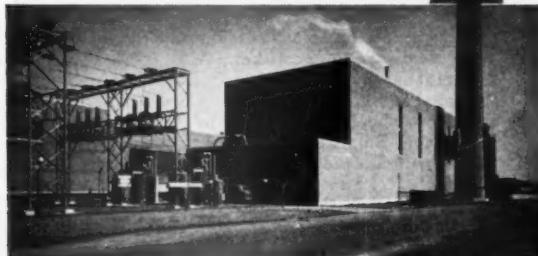
The M. B. Austin Co., Northbrook, Ill.; Clayton Mark & Co., Evanston, Ill.; Clifton Conduit Co., Jersey City, N. J.; General Electric Co., Bridgeport, Conn.; The Steelduct Co., Youngstown, Ohio; Pittsburgh Standard Conduit Co., Pittsburgh, Penn.; Wagner Malleable Products Co., Decatur, Ill.; J. B. Richards Co., Carnegie, Penn.; Kondu Mfg. Co., Ltd., Preston, Ont.

long lived

at YALE & TOWNE'S new Philadelphia Plant



From this 34.5 KV substation, Keystone-Hazaprene 5 KV Cables serve as underground primaries carrying the 2400 volt, 3 phase current to the main switchboard in the boilerhouse.



Keystone-Hazaprene 600 volt control cables operate from the switchboard in this boilerhouse, underground to the 4 substations that supply current to the equipment manufacturing famous Yale and Towne lift trucks and machine tools.

n excellent example of modern design and construction, the new Yale and Towne Plant in Philadelphia is typical of current industrial building...here you'll find Keystone-Hazaprene Cables. Like new plants, cables are an investment, and Keystone-Hazaprene pays off with the premium performance and long, maintenance-free service that means long term economy.

For high voltage circuits, Hazard's Keystone Insulation effectively combines in one oil-base compound remarkable resistance to ozone, heat, and moisture. Protected with a Hazaprene sheath—a tough Hazard-developed neoprene compound that resists abrasion, oil, moisture and chemicals—Keystone-Hazaprene Cable assures the long, reliable service that reduces operating costs.

In planning new plants or circuit expansion, you'll find Hazard's engineering staff helpful in selecting proper wires and cables. Over 50 years of manufacturing and service experience provides a solid background of research-tested, field-proven data covering every type of installation. This assistance is available without obligation. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD





A Program for 30 million new Americans

LISTEN to the voices of 30 million new Americans. They are answering the pessimists who say we are threatened with depression because we can't keep our farms and factories busy.

Let these pessimists read the future in the census returns. There is a tremendous upsurge in our population. Last year nearly 4 million babies were born. By 1960 we shall total 170 million people--30 million more than when war ended in 1945. This adds to our domestic market more people than there are in Canada and Australia combined.

Providing for these 30 million new Americans can keep our production machinery going at capacity. They call for new hospitals, schools and churches. Larger families need bigger houses to replace post-war houses that are too small now. More and bigger

families need improved home equipment and more new automobiles. In short, to maintain and improve living standards for our children, we must work harder than ever before. To supply the needs of our 1960 population, including adequate national defense, it is estimated that the productivity of the individual worker must increase at least 30%, with additional investment of over 200 billion dollars in capital facilities.

There should be no room in this picture for depression. But we must have economy in government, elimination of waste and extravagance and a reduction of taxes and public debt. If we encourage private incentive, thrift and investment, we can bring about the greatest advance in health, wealth and happiness that America has ever known.



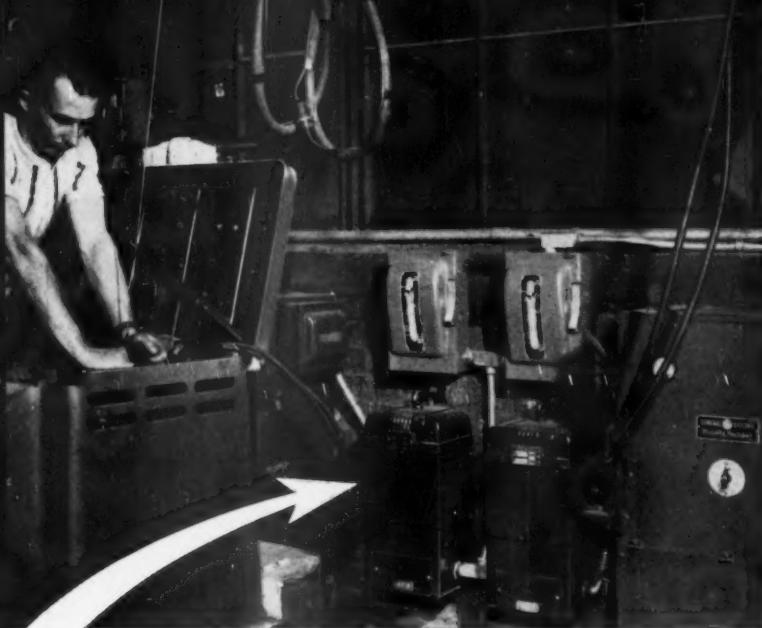
The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio

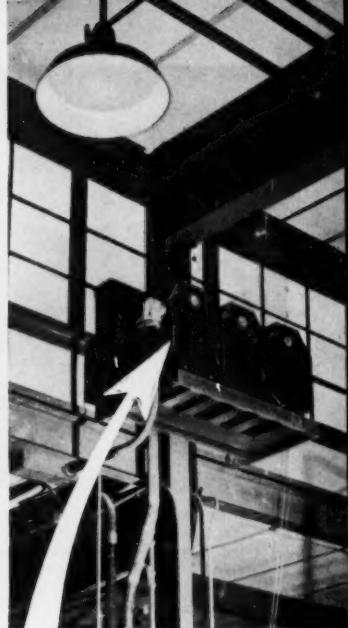
Export Offices--500 Fifth Avenue, New York

MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.



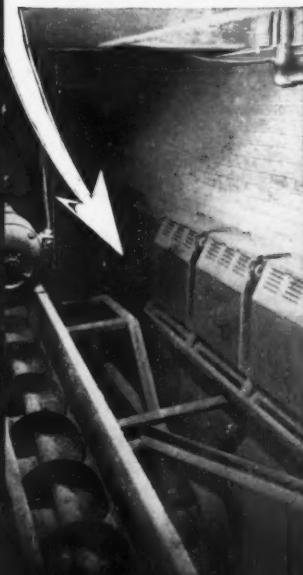
POWER for machines, portable tools and other 115 or 230 volt loads can be supplied at substantial savings when voltage is stepped down right at the load. Here Behr-Manning Corp., abrasives manufacturer, serves its G-E Metallic Rectifiers with G-E Type M Transformers.



LIGHTING demands correct voltage for top efficiency. Behr-Manning assures it with G-E Type D Transformers.

Stretch the power dollars in your plant with these G-E Dry-Type Transformers

INDOOR loads use Type D's—25 kva and above. These at Producers' Cotton Oil Co. serve lighting circuits.



Throughout industry, wherever machines, lighting or portable tools require voltage changes, you'll find G-E Dry-Type Transformers making power dollars go further.

By stepping the voltage down to utilization level *right at the load*, they cut line losses and eliminate long, expensive secondary feeders. This means reduced wiring costs, higher installation efficiency—and often lower power costs.

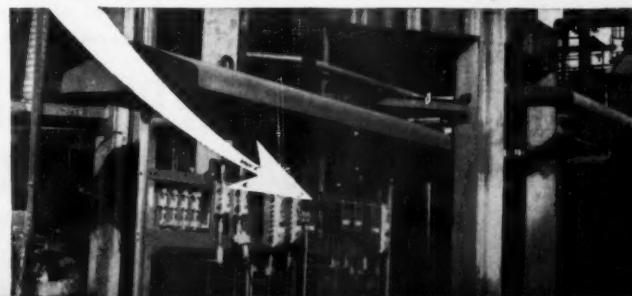
Quiet in operation, lightweight G-E

Dry-Type Transformers require practically no inspection or maintenance. Easy to install, they can be mounted on wall brackets or columns to save floor space. Many larger sizes have solderless connectors to simplify installation.

For additional information on G-E Dry-Type Transformers, call your authorized G-E distributor, today. Or write for bulletin GEC-868A, Section 411-105, General Electric Company, Schenectady 5, N. Y.

GENERAL  **ELECTRIC**

OUTDOOR loads such as this explosion-proof control center at catalytic cracking tower of Phillips Petroleum Company in Borger, Texas, can be served by G-E Type M Transformers. These versatile units are available in .25 thru 15 kva ratings for outdoor or indoor service.





the rocks



NOTICE THE FLEXIBILITY of this No. 4, 5,000 volt AMERCLAD Cable. It contains a special crepe paper slipper applied over the conductors to permit easy bending.



HERE ARE the drills that punch out thousands of feet of holes every day. Notice how easily the cable can be coiled around the take-up reels.



THIS AMERCLAD WELDING CABLE is used at the maintenance shop. The 2/0 375 amp. cable is made up of 3,325 individual wires to provide super-flexible operation and ease the strain on the operator's wrists.

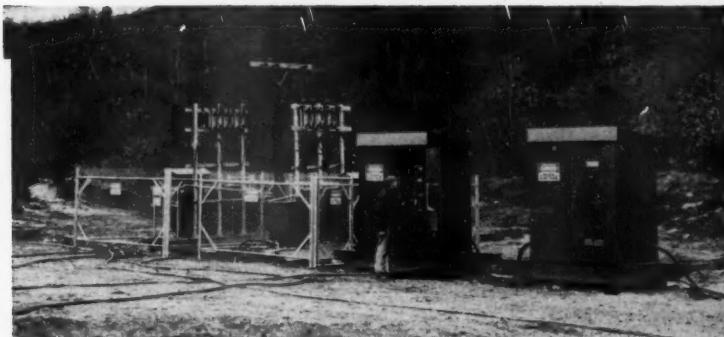
A STANDARD Cable for every

- paper & varnished cambric cables
- asbestos cords and cables
- aerial, underground & submarine cables
- shovel & dredge cables

U·S·S AMERICAN ELECTRICAL



get so hot you can't touch them
**but Amerclad
withstands the heat**



THESE ARE TYPICAL switch houses and portable substation at the mine. Average length of cable used is 2,500 feet. The company has been using the original AMERCLAD for 7 years.

ONE of the nation's leading coal producers is stripping an area that is honeycombed with old mines. Many of these mines are burning, some for as long as 20 years. The rocks get so hot that you cannot walk on them or touch them, but miles of U-S-S AMERCLAD lie on the blistering rock without damage. Naturally, the mine operators try to protect the cable, but a lot of it has to lie on the ground.

This mine uses about 11 miles of AMERCLAD heavy-duty portable cable for power shovels and drills. The cable is unavoidably pulled over razor-sharp rock, soaked in acid water and exposed to the direct rays of the sun. In addition, thousands of yards of dirt and rock are blasted every day, and a lot of it comes down hard on the cable.

Despite all this, the AMERCLAD Cable is turning in a fine record of service. *It has to*, because, as the Chief Engineer puts it, "Every time a shovel is idle, there is a loss of production that is never made up."

If you have an extremely abusive use for portable cable or cord, let us show you just what AMERCLAD can do. There is a standard AMERCLAD Cable or Cord for every special application—whether it's a hand-operated drill, or a river dredge. Just send the coupon.

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL COMPANY
GENERAL OFFICES: CLEVELAND, OHIO

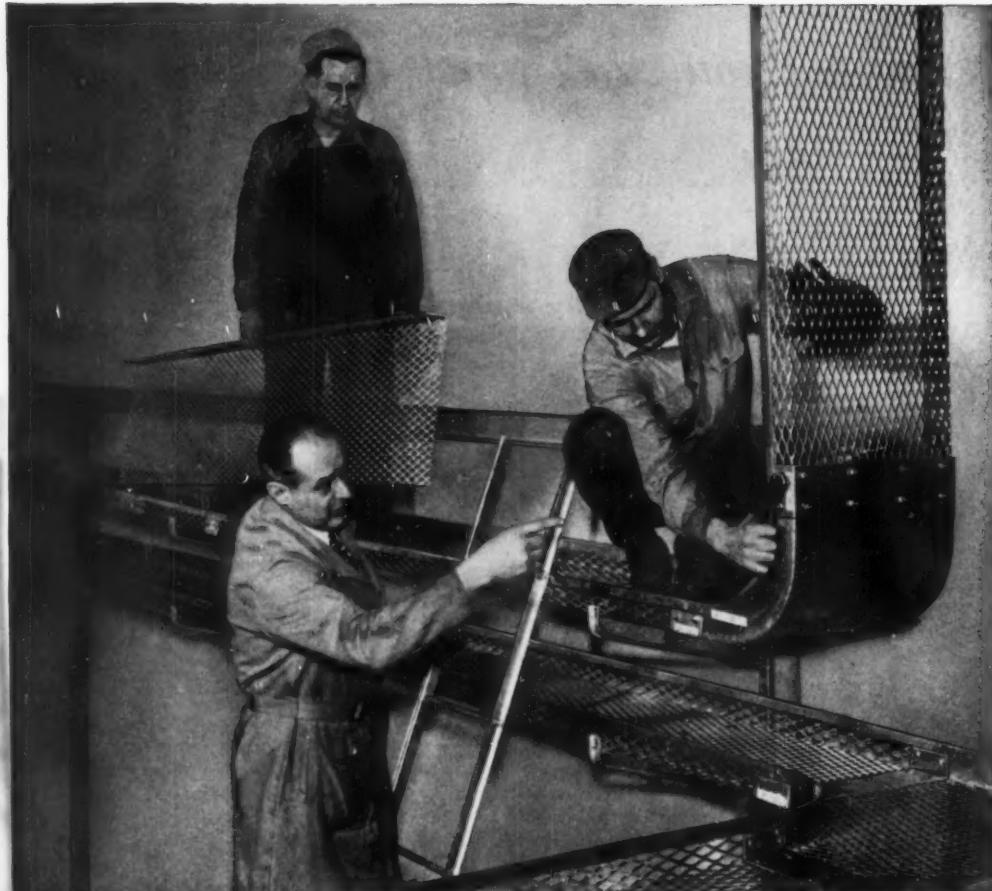
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

SPECIAL Job!

- oilproof portable cords
- plastic machine tool & building wire
- special purpose cords & cables

WIRE & CABLE

UNITED STATES STEEL



LIGHT

.... BUT STRONG!

COPE Cable Trough is both strong and light. These two important factors help to give you a simple and versatile standard system for supporting cable, which will save you in... material, man hours and costs.

Write today for full information on COPE Cable Trough.

You know Cope by
these products



T.J.

Cope INC.

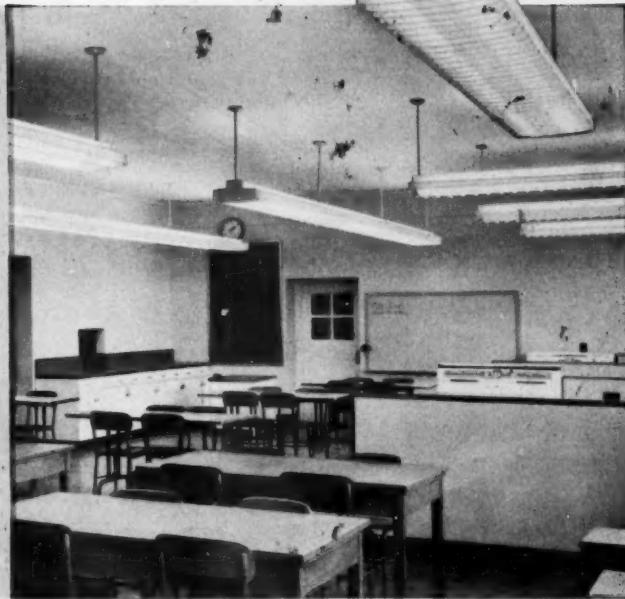
711 South 50th St. Philadelphia 43, Pa.

NOW... at no extra cost

**New, lead-lag
ballast for all
Westinghouse
Slimline
Luminaires**



—ETL and
UL approved



Complete change in design now makes *lead-lag* ballast performance for slimline fixtures no longer a luxury. You can forget about lamp replacement guesswork—you can be sure of full-rated lamp life, and pay no more than for slimline fixtures with series ballasts. That's because the new, Westinghouse *lead-lag* ballast retains all series ballast advantages: smaller, lighter weight, lower cost, minimum wattage loss. Get the complete story, B-5615, Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa. Take advantage of Westinghouse *lead-lag* ballast and specify Westinghouse slimline. J-04318

YOU CAN BE **SURE**...IF IT'S
Westinghouse

LIGHTING DIVISION

Edgewater Park, Cleveland, Ohio





LIGHTING FIXTURES

EXPLOSION-PROOF

CLASS I, GROUPS C & D

Wherever flammable materials are manufactured or used by industry, the complete line of R & S explosion-proof lighting fixtures is specified for the extra margin of safety and protection provided personnel and equipment in hazardous locations. There's an R & S fixture for every need . . . in pendant, ceiling, bracket or hand types . . . from 100 watt through 500 watt sizes. Standard conduit bases permit interchangeability of reflector globe assemblies.

WRITE FOR CATALOG NO. H-47



Ceiling Type with Guard
— without Reflector



Pendant Type with Guard
and Dome Reflector



Bracket Type with Guard
— without Reflector

VAPORTIGHT

The complete line of R & S Vaportight lighting fixtures offers maximum safety and protection against non-inflammable vapors, dusts and mists. The fixtures are available in a range of ceiling, pendant and bracket types in 15 watt, 100 watt and 200 watt sizes. Each has a glass chamber that may be easily cleaned when required. R & S Vaportight fixtures are designed for maximum efficiency and superior illumination. These fixtures have won in every test-winning popularity and industry-wide acceptance.

WRITE FOR CATALOG NO. 904-4

Sold through Electrical Wholesalers

RUSSELL & STOLL COMPANY INC. 105 BARCLAY STREET, NEW YORK 7, N. Y.



RUSSELL & STOLL

Fast Motor Service Wherever You Are



Factory approved motor service in every
industrial area from 97

Allis-Chalmers Certified Service Shops.

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Miami—Peninsular Armature Works
Tampa—Tampa Armature Works

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Atlanta—Bearden-Thompson Elec. Co.
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Marion—Giles Armature & Elec. Wks.
Mt. Vernon—Dowzer Electric

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IOWA

Sieuix City—Smith Elec. & Supply Co.

KANSAS

Salina—Cent. Kans. Elec. Mach. Co.
Wichita—Tarrant Electric Mach. Co.

LOUISIANA

New Orleans—Industrial Elec., Inc.
Shreveport—Shreveport Arm. & Elec.

MAINE

Brewer—Stanley J. Leen Co.

MARYLAND

Baltimore—Keystone Electric Co.

MASSACHUSETTS

Lawrence—Roland B. Ollins Co.
Boston—Rosen Electric Motors
Springfield—Elec. Motor Repair Co.

MICHIGAN

Detroit—Stecker Electric Company
Grand Rapids—Grand Rapids Ind. Elec.
Saginaw—Banning Elect. Prod. Corp.

MINNESOTA

Duluth—Mieke Electric Works

Minneapolis—Persons Elec. Co.

MISSISSIPPI

Vicksburg—Ludke Electric Co., Inc.

MISSOURI

Kansas City—Boose-Hilburn Elec. Co.
St. Louis—French-Gerlman Elec. Co.
Springfield—Springfield Elec. Serv.

NEBRASKA

Omaha—Omaha Electrical Works

NEW HAMPSHIRE

Concord—A. S. Tracy

NEW JERSEY

Atlantic City—Charles A. Buckley
Paterson—Elec. Services Repair Co.
Trenton—Lockwood Elec. Motor Serv.

NEW MEXICO

Albuquerque—Electric Motor Company
Pewell Electric Co.

NEW YORK

Buffalo—Robertson Electric Co.
Jamestown—A. E. Westburgh
Rochester—A. E. Westburgh
New York—Concord Elec. Service Co.
Rochester—Vanderlinde Elec. Corp.
Utica—Mother, Evans & Dashi Co.
Watertown—Watertown Elec., Inc.

NORTH CAROLINA

Charlotte—Southern Elec. Service Co.
Greensboro—Southern Elec. Serv. Co.
Rocky Mount—Hammond Elec. Co.

OHIO

Cincinnati—Cincinnati Elec. Equip.
Electric Service Co.
Akron—A-C Supply Co.
Toledo—Remanoff Elec. Motor Serv.
Youngstown—Winkle Electric Co.

OKLAHOMA

Miami—Miami Armature Works
Oklahoma City—Southwest Elec. Co.
Tulsa—Smith-Milligan Electric Co.

OREGON

Eugene—Kalen Electric & Mach. Co.
Portland—Milwaukee Mach. Co.

PENNSYLVANIA

Johnstown—Universal Elec. Mfg. Co.
Osceola Mills—Mid-State Elec. Eng. Co.
Philadelphia—Elec. App. & Repair Co.
Pittsburgh—Penn. Elec. Coll. Corp.
York—Industrial Electric Company

SOUTH CAROLINA

Greenville—Southern Elec. Serv. Co.
Spartburg—Southern Elec. Serv. Co.

SOUTH DAKOTA

Sioux Falls—Electric Motor Repair

TENNESSEE

Columbia—Middle Tenn. Arm. Wks.
Lafayette—Southern Elec. Works
Memphis—Indus. Elec. & Supply Co.

TEXAS

Amarillo—G. E. Jones Elec. Co.
Beaumont—Elec. Mach. & Repair
Dallas—Industrial Elec. Equipment Co.
El Paso—B & M Machinery Co.
Fort Worth—Elec. Service Co.
Houston—Roy A. Barentz Co.
Sweetwater—Sweetwater Electric Co.

UTAH

Salt Lake City—Diamond Electric

VIRGINIA

Richmond—Wingfield & Hundley
Roanoke—Virginia Armature Co.

WASHINGTON

Spokane—Lee F. Austin Company

WEST VIRGINIA

Charleston—Charleston Elec. Supply
Fairmont—Central Elec. Repair Co.

WISCONSIN

Barron—Utility Transformer Equip. Co.
Green Bay—Bemster Electric Co.
Milwaukee—Diaz Electric Co.
Wausau—Electric Motor Service
Wisconsin Rapids—Staub's Elec. Wks.

Sold . . .

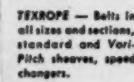
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magnetic and combination
starters; push button
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for complete control
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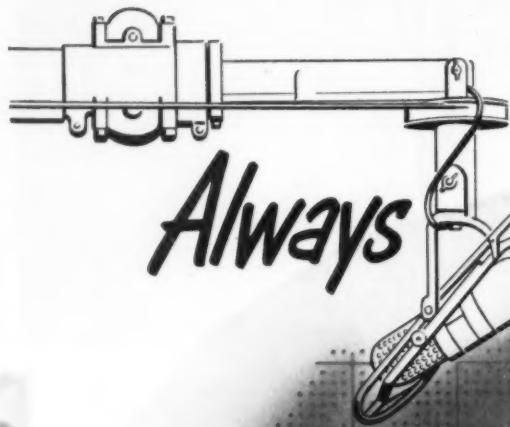
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to 72 in. discharge
and up.

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Studios of WGN and WGN-TV, Chicago,
where ELECTRUNITE E.M.T. protects
power and communications circuits.

Workmen find ELECTRUNITE E.M.T.
easy to cut, easy to bend accurately, easy
to pull wires through.





and ELECTRUNITE E.M.T.

helps get it on the air

...Ever Since 1936

Another customer who came back for more!

When the studios of Radio Station WGN were built in 1936, the electrical and communication circuits were encased in ELECTRUNITE E.M.T.

In 1951, when these studios were expanded to house Television Station WGN-TV, ELECTRUNITE E.M.T. again got the job. This light-and-strong steel raceway protects vital circuits in large and small buildings from mechanical injury, moisture, and fire.

ELECTRUNITE E.M.T. is approved by the National Electrical code for concealed, exposed, and concrete-slab installations. It carries the Underwriters' Laboratories Seal of Approval. It is being used in leading construction projects throughout the country . . . in hospitals, industrials, schools, churches and office buildings.

Your journeyman will like working with ELECTRUNITE E.M.T. . . it's easy to bend accurately with the exclusive "Inch-Marked" feature . . . it's easy to pull wires along the exclusive inside-knurled surfaces . . . it's readily joined without turning lines using concrete-tight compression fittings.

Convince yourself . . . try ELECTRUNITE on your next project. Ask your distributor for ELECTRUNITE, the "Inched-Marked" E.M.T.

REPUBLIC STEEL CORPORATION

STEEL AND TUBES DIVISION

224 EAST 131st STREET • CLEVELAND 8, OHIO



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ELECTRUNITE E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

"G-E Remote-Control Wiring Is Not Difficult To Install"



"Any electrical contractor can make a competitive bid on an installation of G-E remote-control wiring," says Domenic Faraone of Thomas Electric, Cranston, Rhode Island. "We did the Pilgrim Park houses in Warwick for a figure slightly in excess of that for conventional wiring," added Mr. Faraone. "These houses sell for \$13,000 to \$20,000."

"At first glance it looks like a remote-control system takes a lot of wiring," Mr. Faraone said. "But most of it is lightweight, 24-volt, control wire. You staple it to the studding and it goes in fast. It took a day or so for the men to realize that the installation is actually simple. But it wasn't long before they were making good time. As the men gain experience, the cost spread becomes very small between remote control and conventional wiring."

"Since G-E remote control stirs up business for builders," Mr. Faraone continued, "I am going to recommend it wherever I can."



Rhode Island Houses Sell Like "Hot Cakes" with G-E Remote-Control Wiring

"It's hard to hold down my enthusiasm for G-E remote-control wiring," says Rhode Island builder Romeo S. Picerne of Kelly & Picerne, Inc. "We featured remote control in only one advertisement for our Pilgrim Park homes. The response from the buying public was immediate and the resulting orders very gratifying."

"G-E remote control costs slightly more than conventional wiring," Mr. Picerne said, "but I don't know where you can find a comparable sales feature at this low cost."

Adds Convenience and Safety

G-E remote control is a modern wiring system, using low-voltage switching, that permits you to have as many ON-OFF controls of any light or outlet as you wish . . . including master switches each of which will turn ON or OFF nine lights or outlets from one location. It adds convenience and safety . . . is economical for residential or commercial buildings.

Contractors Manual

Thirty-six page manual gives you all the facts—layout, wiring diagrams, and important installation hints. See your Construction Materials distributor, or write Section D47-1018, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—
GENERAL ELECTRIC

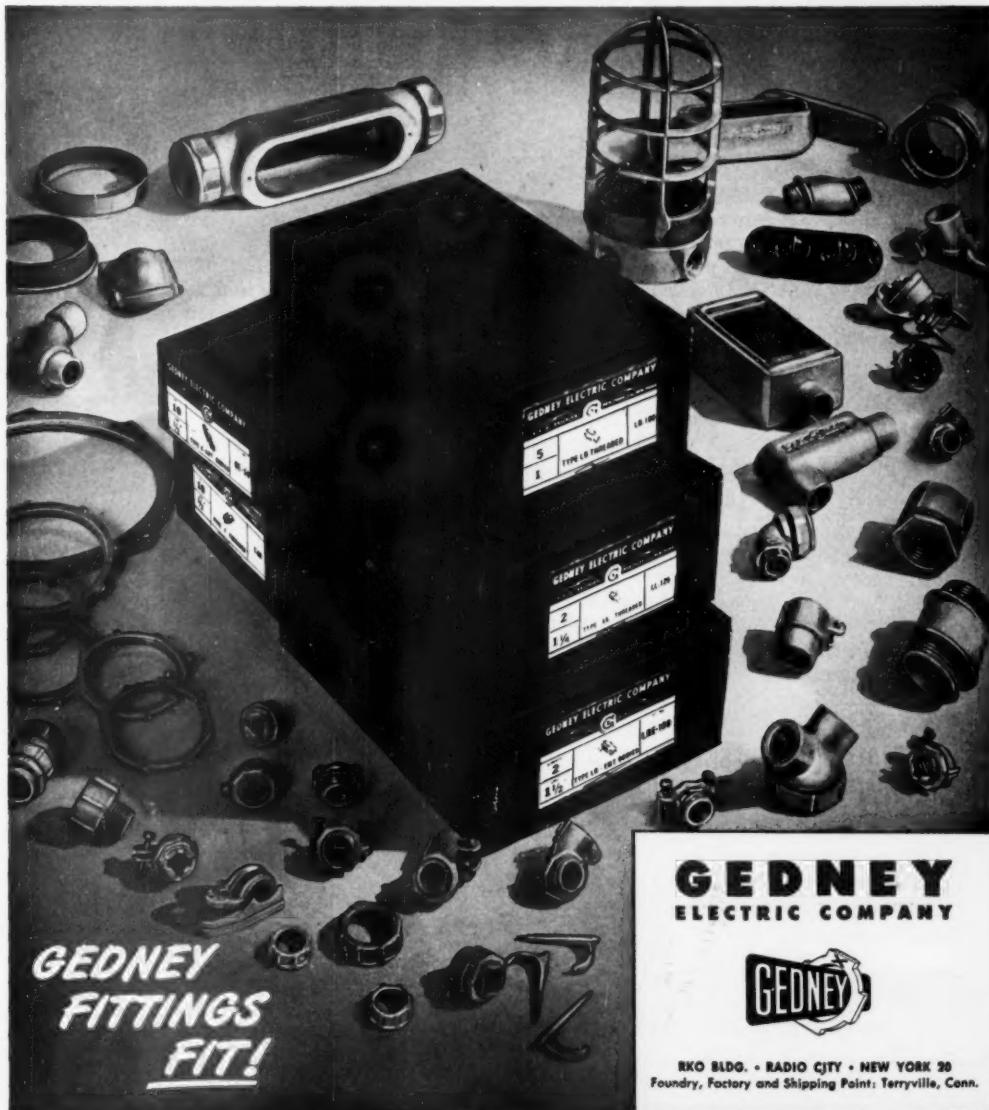
Complete...from A to Ezra!

YES, SIR, Gedney makes a *complete* line...a fitting that's exactly right for every job.

What's more, Gedney fittings are made *completely* in Gedney's foundry and machine shop. Every manufacturing step is under continuous, positive control. Accurate machining and precision threading are assured. Gedney fittings are unbreak-

able MALLEABLE IRON and hot dip galvanized by a special process.

It's no wonder, then, that each and every Gedney fitting gives *complete* satisfaction. Be sure to specify Gedney on your next order. You'll get lasting dependability...at the same time you'll be slashing installation time and costs.



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THIS IS NOT a TAFT-HARTLEY CIRCUIT BREAKER

Unique in the field of circuit protection equipment, **HEINEMANN** Circuit Breakers do not require a "cooling-off period." Immediately after correction of a fault, either short circuit or overload, **HEINEMANN** Circuit Breakers can be turned ON. There is no waiting for a thermal element to cool . . . no wasted production time . . . no reset procedure . . . just restore service by throwing the switch to the ON position.

NO WAITING TO RESET . . . YET NEVER NUISANCE TRIPPING

While there is no waiting to reset after tripping, **HEINEMANN** Circuit Breakers do provide time delay before tripping to allow for **temporary, harmless** overloads, thus avoid nuisance tripping. This allows for the initial inrush of starting motors and other equipment.

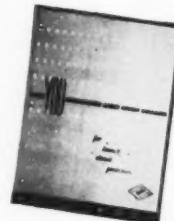
TIME DELAY FOR OVERLOADS . . . YET INSTANTANEOUS SHORT CIRCUIT PROTECTION

Beyond providing time delay for overloads, the hydraulic-magnetic operating principle of **HEINEMANN** Circuit

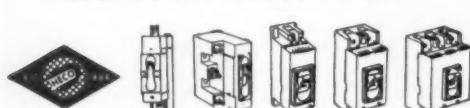
Breakers differentiates between overloads and short circuits. **HEINEMANN** Circuit Breakers always trip instantly at ten times the rated current . . . providing the fast protection you must have for your wiring and equipment even at the low short circuit values.

KNOW THE FACTS . . .

Send for this new informative booklet entitled, "WHAT YOU SHOULD KNOW ABOUT CIRCUIT BREAKERS." Ask for Manual 101 . . . no obligation, of course.



HEINEMANN ELECTRIC COMPANY
132 Plum Street • Trenton 2, N. J.



Heinemann Circuit Breakers. One, two and three pole. 10 millamps to 100 amperes.

HEINEMANN
Circuit breakers

for every S E lighting installation-

Electro Silv-A-King



Commercial Fluorescent A complete range of models in all sizes... Regular, Rapid Start and Slimline. Illustrated is the SKYLOUVER Water-thin with plastic moulded louvers that won't warp, crack, chip, or discolor... one of the famous "Basic Unit" series offering complete interchangeability of seven different louvers on the same basic chassis.

Industrial Fluorescent R.L.M. Heavy duty, economically priced units for every purpose... designed to achieve greater efficiency and incorporating many advanced engineering features for easier installation and maintenance. Available in a complete line of Regular, Rapid Start and Slimline.



Incandescent Lighting R.L.M. For indoor and outdoor use... for industrial and commercial purposes, athletic fields, etc... including open and closed units, flood, spot and portable lights... and a complete line of accessories.

Architects, contractors and builders are now utilizing ELECTRO SILV-A-KING as one of their most important basic sources for every lighting fixture need.

The combined, comprehensive facilities of this new organization with over 50 years of experience... and an extensive, nation-wide network of sales offices staffed by experienced lighting engineers offers new, important assistance in planning and supply for every type of job.

Two strategically located manufacturing plants insure rapid, economical delivery throughout the country.

Plan now for easier, better lighting installations! Contact your local ELECTRO SILV-A-KING sales office or write direct to...

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CUT HANDLING COSTS SAVE STORAGE SPACE WITH GUTH TELESCOPING CHANNELS *

8 FT. CHANNEL... ONLY 5 FT. LONG!

Now one man can do the job of two

Easier to handle—One man can carry a Guth "Telescopic" Channel anywhere—even in an elevator. Compactness makes them easier to load safely on skids, trucks, etc.—reduces transportation damage.

Easier to store—Guth "Telescopic" Channels require 45% less space in warehouse and on-the-job storage.

Extra strong—Overlaps at joining points result in extra strength and rigidity.

Fully wired . . .

Special joiners assure perfect alignment of several channels in a line. Three overall lengths: 10, 8 and 6 ft.

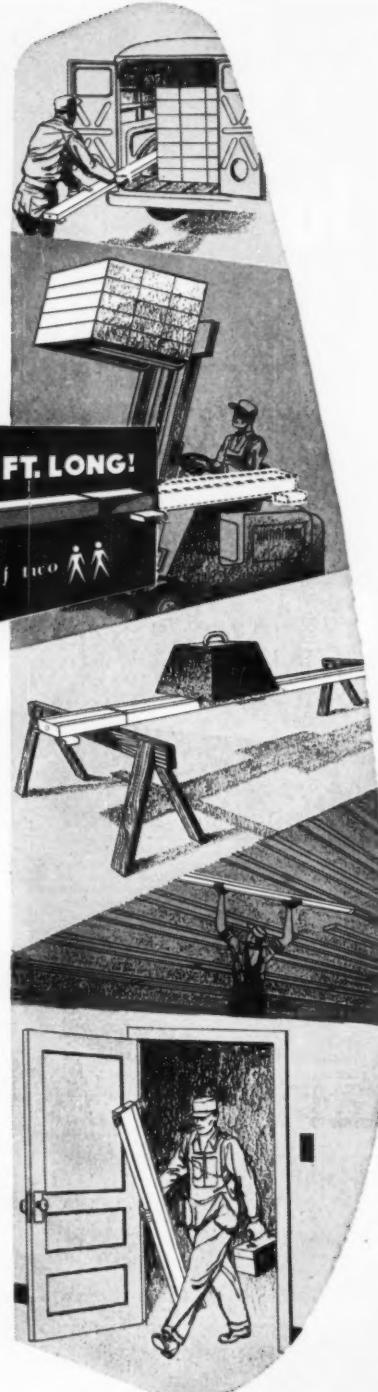
See your GUTH resident engineer or write
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THE EDWIN F. GUTH CO.

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LOW COST METHOD OF ELECTRICAL DISTRIBUTION

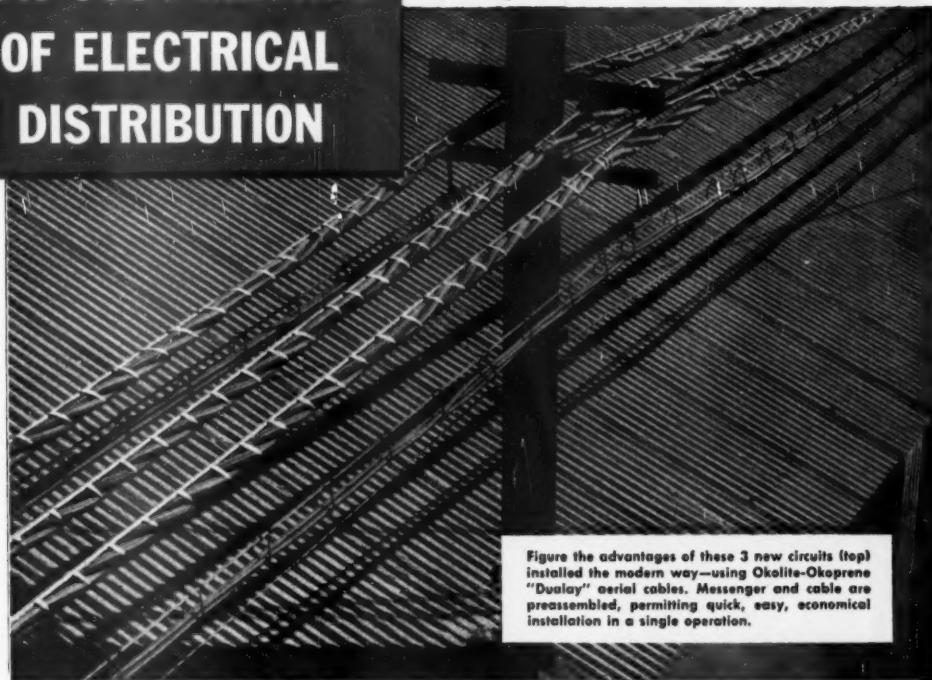


Figure the advantages of these 3 new circuits (top) installed the modern way—using Okolite-Okoprene "Dualay" aerial cables. Messenger and cable are preassembled, permitting quick, easy, economical installation in a single operation.

Okolite-Okoprene self-supporting aerial cable systems can solve a number of electrical cable problems in heavy power-consuming plants.

In such plants as steel, chemical, petroleum, glass, paper—or any fabricating and processing industry—an Okolite-Okoprene aerial cable system offers:

Money-saving advantages over duct systems.

Operational advantages over open wire circuits.

Preassembled Okolite-Okoprene self-supporting cable can be installed in a single operation quickly, easily and economically, often by making use of existing structures. Line taps and splices are simple. And of course there is no need for expensive trenching and ducting.

Because of its extremely high dielectric strength, Okolite-Okoprene gives better voltage regulation,

eliminates flashover outages, and provides greater safety to personnel than conventional overhead wiring. Long, trouble-free service is assured by Okonite's famed processing methods. Premium materials, exclusive manufacturing techniques and proved formulas for insulation and sheath, combine to resist attack from moisture, heat, weather, dust and acid-laden atmosphere.

Bulletin, EC-1058 gives 52 pages of facts on why Okolite-Okoprene self-supporting aerial cable is truly an economical buy. Write for it today. The Okonite Company, Passaic, N. J.

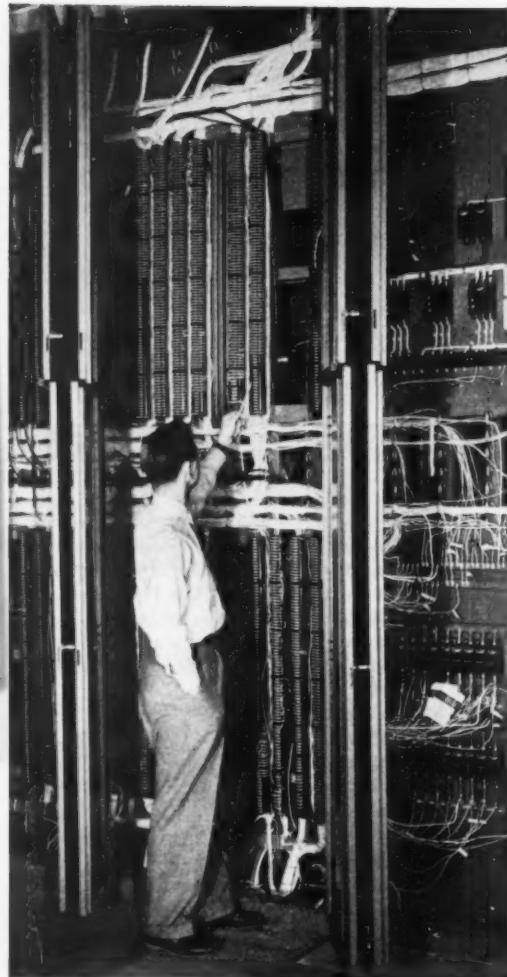


The best cable is your best policy



insulated wires and cables

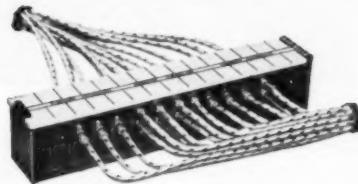
over 100 miles of cosmotron



Bank of Control Terminals of Brookhaven
Cosmotron, with compact, trouble-free wiring made possible by use of three different types of Burndy connectors.

Burndy connectors are integral units of the Cosmotron electrical control panels . . . because Burndy combines *maximum electrical efficiency with mechanical strength* that withstands the most severe stress and vibration. What's more, in the over 100 miles of wiring, hundreds of thousands of electrical connections were made largely by *electricians without special training*—because Burndy connectors rely on *engineered design* to insure stable, secure connections.

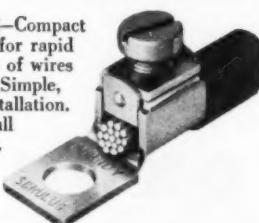
Naturally, Burndy is very proud to be part of the Brookhaven Cosmotron—and equally proud of our myriad everyday jobs in utilities, industry, manufacturing, general service.



CRABLOKS—Quick-connect, quick-disconnect terminal blocks, placed end-to-end, provide multiple secure terminal connections in small space.

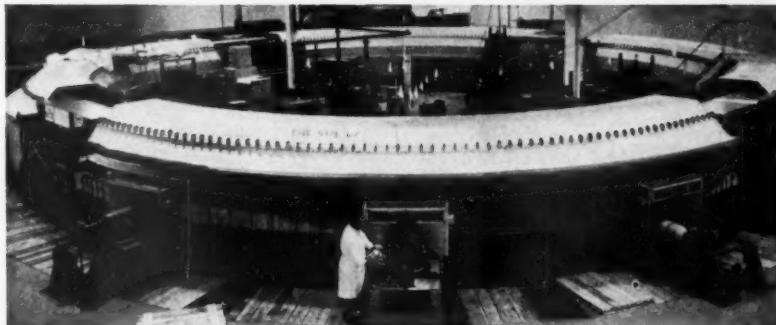


HYLUGS
—Indent-type terminals—with matched Burndy tooling—provide secure, uniform, low-resistance connections, easily installed and inspected.



SCRULUGS—Compact connectors for rapid termination of wires and cables. Simple, one-tool installation. Maintain full re-usability.

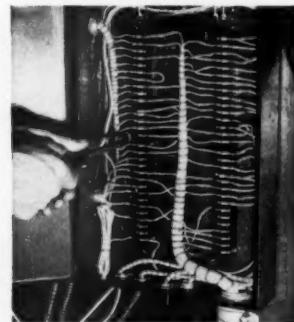
circuits connected by BURNDY



Cosmotron at Brookhaven National Laboratory, Upton, L. I. World's most powerful atomic accelerator utilizes 40 million watts, accelerates nuclear particles to 170,000 miles per second.



View of the Cosmotron, showing diffusion pump, with terminal box in foreground.



Terminal box at left with
Burndy Crabloks and Hylugs.

BURNDY

BURNDY ENGINEERING COMPANY INC., NORWALK, CONNECT.

BURNDY CANADA LTD., TORONTO 8, ONT.

SORGEL

AIR-COOLED

Dry-Type

TRANSFORMERS

for Every Purpose

To operate 115 volt lighting and portable equipment from 230, 460 or 575 volt power circuits, and higher distribution voltages.

To operate special equipment from standard circuits.

To change odd voltages to standard voltages and phase changing.

Also Sub-Stations and Power Centers

for indoor installations

Engineered to meet your exact requirements. Not necessary to design or change your installation to fit a "standard."

Any type of primary switch gear.

Metering—primary or secondary, to suit.

Secondary breakers, main, branch, or tie.

All incorporated with high quality, liberally designed SORGEL Air-Cooled Transformers. All factory assembled, wired and tested. Mounted on a substantial steel base. Shipped as a single unit or in sections, accurately co-ordinated for easy assembly on the job.

Sizes up to 2000 Kv-a. All voltages up to 15 KV.

Complete Line

1/4 to 2000 Kv-a.

Single phase and poly-phase.

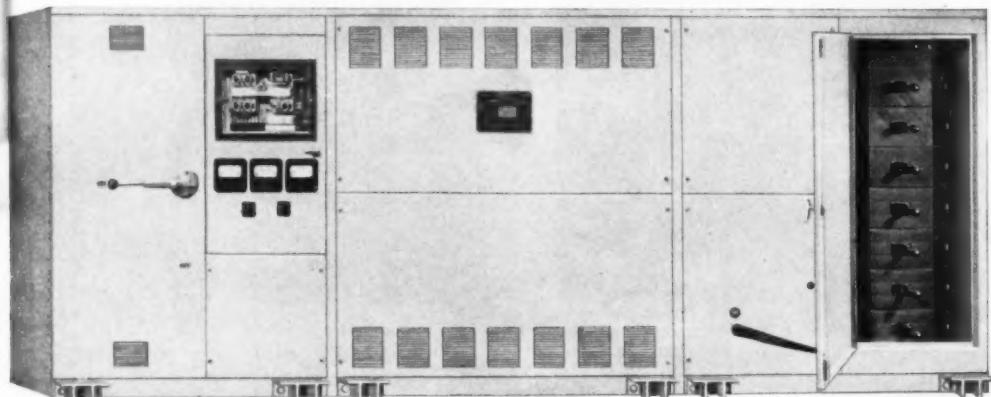
120, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and 14,400 volts



1/2 Kv-a.
Single phase
460/230 to
230/115 volt



20 to 50 Kv-a., 3-phase. Wall Mounting Type.



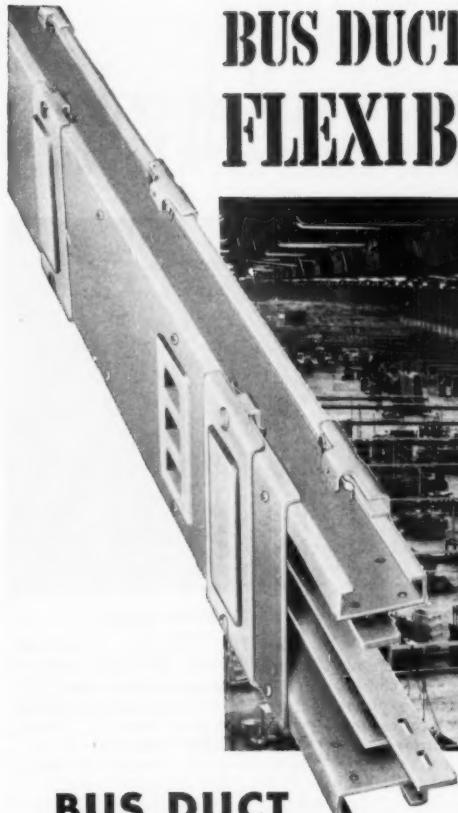
500 Kv-a. 3-phase, 4160 volt Sub-Station.

With primary fused load break switch. Recording watt-hour meter with demand register. P.F. Indicator, volt and ammeter. Secondary main circuit breaker and distribution panel.

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Transformers



BUS DUCT

solves high bay distribution problem

Mounting on angle iron standards proves highly flexible

An extremely high created a serious secondary power distribution problem at the Tulsa Plant of the Douglas Aircraft Company.

Douglas solved the problem uniquely, by mounting 4,600 feet of 400 ampere, 3-wire, 3-phase, Westinghouse Plug-In Bus Duct from angle iron standards resting on the floor. Unequalled plant layout flexibility resulted.

All Bus Duct runs are convenient to machines and exposed to view. They're mounted high enough to be out of the way, but low enough to plug in or service easily. (See circle inset.) No material is wasted with long, unnecessary lead-ins to machines; no time is lost checking circuit feeds. Machines can be shifted without affecting Duct.

Perhaps this manner of Bus Duct installation can be applied to solve a similar problem in your plant or building. Four types of Westinghouse Bus Duct are available for any service demand up to 5,000 amperes.

Get complete details from your Westinghouse Representative or write for B-4272-A, Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Penna.

J-30111

YOU CAN BE SURE...IF IT'S

Westinghouse

BUS DUCT

W

WESTINGHOUSE ELECTRIC COMPANY

WESTINGHOUSE DISTRIBUTOR

I-T-E announces 4 new circuit breakers

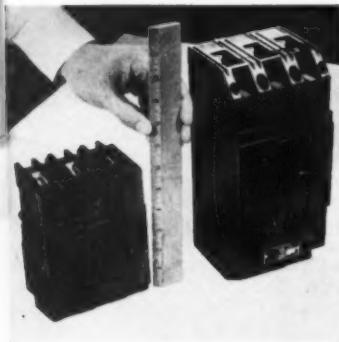


Conference following announcement of four new I-T-E panelboard circuit breaker designs. J. E. Kleinfelder, left, Sales Manager of the Small Air Circuit Breaker Division, listens as W. H. Edmunds, Engineer in Charge, explains the operating advantages of externally-adjustable instantaneous trip feature. Each of the four new breakers was designed specifically to improve construction and operation of panelboard and load center assemblies.



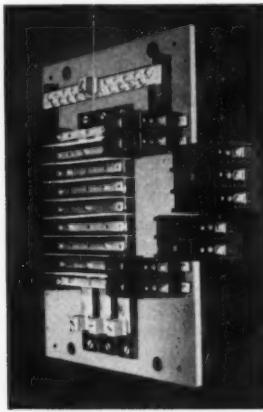
SAVES SPACE

Both I-T-E breakers are rated 225 amperes. New "J" frame, right, is $4\frac{1}{2}$ inches shorter than present "K" frame. Benefits of this new design will be reflected in compact distribution-type panelboards and combination motor starter enclosures.



DOUBLES CAPACITY

Small lighting and distribution-type panelboard construction, previously limited to 50 ampere breaker capacity, may now incorporate 100 ampere branch circuits. New I-T-E "E" frame breaker, left, now has the same capacity as the "F" frame breaker shown above. New "E" frame will be advantageously applied up to 250 volts a-c wherever space conservation is required.



FIRST 2- AND 3-POLE EQ

New multipole EQ-type breakers are exact multiples of present single-pole design. Any given number of poles take the same space in panelboard. No tie-bar arrangements are necessary; all poles operate on common trip.



TINY, NEW EQP

This small, new single-pole EQP breaker now provides more compact plug-in lighting panelboards with all the features of I-T-E quality construction.

**YOU STAY YEARS AHEAD
WHEN YOU SPECIFY ...**

LOOK FOR RADICAL IMPROVEMENTS IN PANELBOARD AND LOAD CENTER DESIGN

Sweeping new improvements in the construction and reliability of future panelboards and load centers can now be expected, with introduction of four new circuit breaker designs developed by the I-T-E Circuit Breaker Company.

Three of the new units are advanced modifications of proved I-T-E designs in the 50, 100, and 225 ampere ratings. The fourth unit, a new, smaller addition to the present line of I-T-E molded case circuit breakers, is specifically designed for use in lighting panelboard and load center applications.

MORE COMPACT DISTRIBUTION-TYPE PANELBOARDS

Panelboards housing two 225 ampere breakers are shortened 9 inches, as result of a $4\frac{1}{2}$ -inch decrease in height of the present I-T-E "K" frame breaker. This size reduction now makes it possible to double-butt two of these new, short "J" frame breakers in the same vertical space formerly required for the one larger unit. The width of one whole breaker (9 inches) is saved.

SMALLER COMBINATION STARTERS

Motor-starting-equipment enclosures, using a circuit breaker in combination, can now be reduced as much as $4\frac{1}{2}$ inches in height. I-T-E 225 and 100 ampere breakers have been shortened accordingly, without sacrificing electrical clearances or current-carrying capacities.

NOW... LIGHTING- AND DISTRIBUTION-TYPE PANELBOARDS UP TO 100 AMPERES

Where combination lighting and power panelboards were formerly limited to 50 ampere branch circuit ratings, the same type panelboard can now be obtained with 100 ampere capacity branch circuits. Redesign of the I-T-E "E" frame breaker doubles its current rating to 100 amperes at 250 volts a-c.

Also included in this "E" frame revision are 15 and 20 ampere ratings for fluorescent lighting applications at 277 volts a-c.

SIMPLIFIED MULTIPOLE PANELBOARDS

Compactness of multipole 50 ampere panelboards is improved and installation simplified through use of the new I-T-E two- and three-pole EQ breakers. First of their type available anywhere, these new multipole breakers fit all existing panelboard and load center designs in which single-pole breakers were formerly used. No tie-bar arrangements are necessary; all poles operate on common trip.

SMALLER PLUG-IN TYPE LIGHTING PANELBOARDS

Compact lighting panelboards and load centers for residential and commercial service can now incorporate all the advantages of I-T-E quality circuit breaker protection. The new, small I-T-E single-pole EQP design which makes this possible provides quick-make, quick-break operation and convenient plug-in feature.

ONE MANUFACTURER'S BREAKERS THROUGHOUT

Plant and operating engineers, electrical contractors, and electricians desiring uniformity of construction and components throughout their secondary distribution systems can now specify the largest variety of molded case circuit breakers for all applications up to 600 amperes, 600 volts a-c, 250 volts d-c. Frame sizes and types are available to suit any residential, commercial, or industrial requirement.

Standardize on I-T-E circuit breakers to assure service continuity, simplified maintenance, a single source for system expansion or replacements, and—always—the same, proved I-T-E dependability throughout.

FULL DETAILS AVAILABLE FROM YOUR LOCAL PANELBOARD BUILDER



MOLDED CASE CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER COMPANY • 19TH AND HAMILTON STS. • PHILADELPHIA 30, PA.

Canadian Mfg. and Sales: Eastern Power Devices, Ltd., Toronto • Export Sales: Philips Export Corp., N.Y. 17, N.Y.

Only lighting units that can
meet or exceed approved
standards of quality bear this

RLM LABEL

...and here are these STANDARD SPECIFICATIONS
in the up-to-date, enlarged edition of the
NEW RLM SPECIFICATIONS BOOK

This new, greatly-enlarged RLM Specifications Book contains complete RLM Specification data on a total of 68 types and sizes of fluorescent, incandescent and mercury industrial lighting units. One or more of these units—conforming to RLM quality specifications and certified to bear the RLM Label—is offered by each of 26 manufacturers.

The RLM Label affixed to a lighting unit is a Certificate of Assurance. It assures the buyer that the equipment meets or exceeds certain quality standards established by the RLM Standards Institute and published in its 48-page Specifications

Book. Further, it provides a Warranty of Uniform Quality...a guarantee that every RLM-Labeled Unit off each manufacturer's assembly line will conform constantly and continuously—will never waver below these standards.

You can rely on this Warranty. It is upheld by the extensive RLM Inspection and Certification Program—the real backbone of the RLM Label. As fully explained in the RLM Specifications Book, periodic inspections are made by an independent testing laboratory. Lighting units are checked for conformance to RLM standards as they come off assembly lines, as well as at all levels of distribution.

Send for your COMPLIMENTARY COPY of the RLM Specifications Book. Long recognized as an authoritative aid to everyone who buys, sells, specifies or installs industrial lighting equipment, this enlarged 1952 edition includes coefficient of utilization tables and light distribution curves to make it even more helpful. It puts the whole story on the 68 different RLM Lighting Units right at your fingertips. Your copy of the new edition, RLM Specifications Book is available without cost or obligation. Address your request to: RLM STANDARDS INSTITUTE, Suite 819, 326 W. Madison St., Chicago 6, Illinois.





Stearns road magnets are saving airlines, bus operators and motorists from inconvenience and expense of tire repairs by removing tons of nails, spikes, screws, wire, and other scrap metal from runways and highways. In many cases, the metal recovered more than pays for the operation of the magnets. Coils of these highly specialized, heavy-duty magnets are built to last. They are insulated and protected with Natvar Silicone Coated Fiberglas because of its excellent electrical and mechanical characteristics, particularly its ability to withstand heat and moisture.



NATVAR Silicone Coated Fiberglas



Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubing and sleeving
- Varnished identification markers
- Lacquered tubing and sleeving
- Extruded plastic tubing and tape
- Extruded plastic identification markers

Ask for Catalog No. 22

Stearns Magnetic, Inc., Milwaukee, manufactures magnetic clutches, brakes, separators, pulleys, drums, and other magnetic devices and equipment for industrial uses, where reliability of performance is essential.

This calls for a highly specialized engineering knowledge of magnetism, its practical application to specific problems, and a thorough familiarity with the characteristics of materials under actual operating conditions. Natvar Silicone Coated Fiberglas was selected for their road magnet because of its proven resistance to heat and moisture.

Natvar flexible electrical insulating materials have good electrical and mechanical properties and are consistently uniform, no matter when or where purchased. They are available either from your wholesaler's stock or direct from our own.

NATVAR CORPORATION

FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

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RAHWAY 7-8800

CABLE ADDRESS
NATVAR: RAHWAY, N. J.

205 RANDOLPH AVENUE • WOODBRIDGE, NEW JERSEY



INSTALLATION: North Coventry Township School, Pottstown, Pennsylvania.
DESIGNED BY: Eastern Engineering Co., Reading, Pennsylvania.
AREA: Lower Grade Elementary Classroom 24' x 30'.
CEILING HEIGHT: Approximately 9'-6".

FIXTURES: 15 - Litecontrol No. 9224 surface mounted, using Halophane No. 9100 CONTROLLENS®
SPACING: 8'-0" on centers.
INTENSITY: On desk top beneath fixtures, 70 foot-candles initially. Average over room, 47 footcandles initially.

Bright Solution to an old classroom problem ...furnished by LITECONTROL

EYES have it easy in this light, attractive classroom. Note the even illumination . . . the absence of glare . . . the ease of seeing . . . all carefully calculated to protect young eyes . . . keep them alert and learning all day long.

Add to this the smart appearance of LITECONTROL's standard lighting fixtures No. 9224 . . . plus their unusually low cost of upkeep . . . and

there you have the three big advantages offered by LITECONTROL's complete line of standard lighting fixtures: Good light for good sight, with good looks, and easy maintenance.

When you want the same — a lighting installation that's custom in appearance . . . at standard fixture costs — consult your local LITECONTROL Representative. *Reg. Trademark



LITECONTROL Fixtures

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALE

MIDGET SIZE

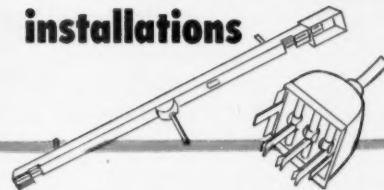


POWER PLUGIN

BUSDUCT



provides "Plug in and Go" Power for smaller installations



small pump motors on return lubrication systems.

Midget Size POWER PLUGIN Busduct is only 3½ inches wide and 2 inches deep in size. It is available in five and ten foot sections with plugin outlets every twenty inches thus permitting machines to be moved in and out of production lines without slowing down or delaying operations. Special lengths and closer spacing of outlets are also available for application on production benches and equipment.

Contact your nearest representative, listed in Sweet's, or write for Bulletin No. 704, for further information on this economical, flexible system of power distribution.

Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MISSOURI

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER



Our 61st
Year



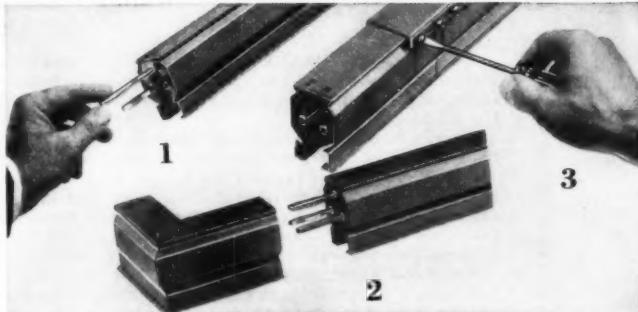
1. Here's the most modern way to plan and install a low-voltage distribution system. Trumbull calls it FLEX-A-POWER, but the name is only a small hint of the flexibility it offers to electrical equipment distributors, contractors and the customers they serve. LTG FLEX-A-POWER—one of four different types—

is a pre-fabricated trolley and plug-in busway that becomes one continuous electrical outlet. The photograph above shows how easy it makes the positioning of a lighting fixture, a power tool, a business machine or appliance *exactly* where it will do the most good.

How to SIMPLIFY planning and installing of low voltage distribution systems

**LTG FLEX-A-POWER® PERMITS NEW TECHNIQUES
THAT MAKE WORK FASTER, MORE PROFITABLE**

2. IT'S EASY TO CONTROL INSTALLATION COSTS WITH LTG FLEX-A-POWER because its unique design cuts to a minimum the amount of work necessary. No tools are required to make electrical connections; only a screwdriver for mechanical hook-up. (1) You simply insert ends of the spring loaded bus connectors into the ends of the tubular conductors on one section. (2) Slide the adjacent lengths together until they butt flush. (3) Place the coupling plate over the joint, tighten set screws . . . and move on to the next section. Rating: 50 amps at 300 volts a-c or d-e, in 2, 3 or 4 pole construction.



Electrical distributors like LTG FLEX-A-POWER because its convenient lengths are easy to stock. **Contractors** find that it makes the hard-to-determine installation charge easy to predict. **Users** find it brings new flexibility to their low-

voltage distribution systems while adding new efficiency to plant operations. Remember, too, FLEX-A-POWER can be disassembled and re-installed in a new system as changes require it. *Write for circular TEC-3 on LTG FLEX-A-POWER.*

NO SHORTAGE—Your Trumbull distributor's supply of FLEX-A-POWER is backed by ample factory stocks to meet all your distribution needs.

Trumbull Assures FUTURE FLEXIBILITY in Power Distribution

TRUMBULL  **ELECTRIC**

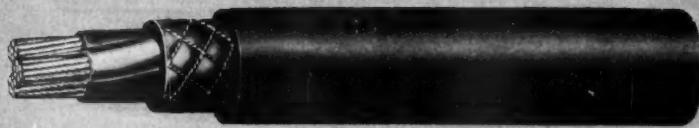
DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

• MAXIMUM PROTECTION AND LONG LIFE •

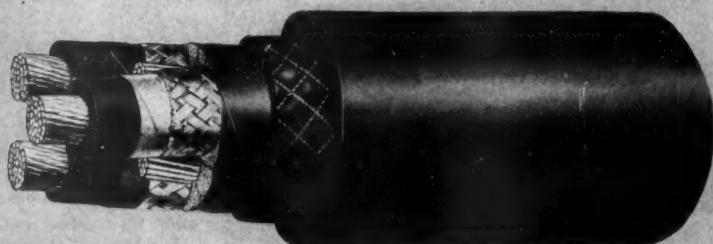
CRESCE

NT
IMPERIAL NEOPRENE

Portable and Industrial Cables



TYPE W-600 VOLT CABLE
For use with heavy duty, portable equipment



TYPE SH-D 5000 VOLT TRAILING CABLE
For supplying power to electric shovels, dredges, etc.



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WIRE and CABLE
CRESCENT **INSULATED WIRE & CABLE CO.**
TRENTON, NEW JERSEY



ELECTRIC FEEDRAIL®

for maximum safety
convenience,
adaptability



CATALOG No. 25
gives the complete Feedrail
story — shows you where,
when and how to install this
modern electric power distribution
system. Write for a copy.

The smooth-rolling trolley outlets can tap power at any point along the entire length of a run. Electrical outlets are always available where or when you need them when ELECTRIC FEEDRAIL is on the job. Additional trolleys can be added in a matter of minutes without shutting off power. If you're planning a plant addition, a revised production set-up, or a new plant—remember that FEEDRAIL is the electric power distribution system you can't afford to overlook. A FEEDRAIL engineer or field representative will be glad to provide you with details. Call him in today.

Sold by leading electrical distributors

52-2

**ELECTRIC
FEEDRAIL®**

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N.Y.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

You "designed" This One!

the NEW

Super Safe



Voltage Tester

With ALL the Features Thousands of
Electrical Men Told Us They Wanted

Before ever a drafting pencil was laid to paper—before our engineers began planning the design of this new IDEAL Voltage Tester... our representatives talked to thousands of electrical men and found out all the things they wanted most in a tester. Then began months of design work—of test models, trials, modifi-

cations, and finally, of getting ready for production.

Now the result is ready for you. We truly believe that in the new IDEAL Voltage Tester you will find every most-wanted feature in the finest, safest tester ever built — by anyone!

No Other Tester Has All of These:

Diagram labels:

- Hondler center mount for prod makes testing easier
- Double strength, seamless plastic case
- Prod storage completely shields sharp tips
- Coil layer-wound on rugged nylon spool for long, safe life
- Coil secured at both ends — Coil leads isolated, preventing shorts
- Molded rubber, moisture-tight prod handles — "No-Slip" safety rings; 36" neoprene leads
- Plastic nameplate bonded to case — no surface metal
- "Fog-free" window keeps out dirt

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"DOUBLE PROTECTION"

... a solenoid, calibrated indicator AND a neon test lamp, each independent of the other—NO CHANCE OF FAILURE TO DETECT VOLTAGE

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1041 Park Avenue, Sycamore, Illinois

Please send me complete catalog information on the new IDEAL Voltage Tester.

Name _____

Company _____

Address _____

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"We found a quick, low-cost answer to our load problem!"

"When we purchased our present plant, we had to find a quick, practical, economical way to step down the existing 440 voltage," says the manager of an eastern plastics factory.* "By installing 24 Westinghouse Dry-Type Transformers on the high-voltage line near our presses, we got the voltage transformation plus the good regulation we wanted. They've proved their reliability by sustaining frequent, heavy overloads for periods up to half an hour."

Whether your load problem involves additions to your production line, large-scale plant expansion, or complete plant conversion, like this manufacturer, Westinghouse Dry-Type Transformers carry these

savings right down your line: *Lower Installation Costs* . . . their small size and light weight need only the simplest mounting. *Lower Operating Costs* . . . mounted close to the center of the load, they assure better power regulation. *Lower Power Costs* . . . they eliminate the losses resulting from long low-voltage runs. *Lower Maintenance Costs* . . . they require practically no maintenance. Available with or without built-in circuit breakers.

Get the complete story from your local Westinghouse representative. Or write to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh, Pennsylvania.

J-70642



you can depend on us
Westinghouse

**DRY-TYPE
TRANSFORMERS**

*Name on request

The Reader His Mark



THE ABC SYMBOL which is printed at the head of this page is, in a very real sense, *your* brand on this magazine. Those letters stand for Audit Bureau of Circulations. The symbol indicates that the magazine is a member and supporter of that Bureau.

To the advertiser who contemplates using the magazine as an advertising medium, this symbol has a well-recognized significance. It tells him that the circulation records and practices of the magazine are wide open to the auditors of the Bureau, who check the publisher's claims and make public the precise terms and conditions under which subscriptions are obtained. And it assures him that the magazine stays in business by virtue of a demonstrated demand from its readers as shown by their paid subscriptions or newsstand purchases.

BUT HERE we are concerned only with the significance of ABC to you as a reader. For when the advertisers, the advertising agencies, and the publishers founded the Bureau nearly forty years ago to help establish honest circulation figures, they unwittingly set up a cooperative institution that has become a major safeguard for the interests of the reading public.

That is because membership in ABC constitutes one of the strongest guarantees that any publication can offer of its primary devotion to the interests of its readers. And by making that guarantee possible, ABC becomes a major safeguard of the freedom of the press, an objective of exceptional importance in these days when the public is flooded with propaganda from so many sources.

THE SUREST MEANS by which to preserve a free press is to keep it directly answerable to the reading public it would serve. It follows, then, that the survival of a truly free press must depend on its acceptance by that public; and that means in turn that the people must have in their hands some adequate means for holding the publishers responsible to them.

No one has yet devised any means to that end more simple, more direct or more practical than the paid subscription or newsstand purchase price. The right to purchase or refrain from purchasing a publication gives to the readers and to no one else the power to pass judgment on whether that publication should continue to serve the reading public.

TO SUPERVISE this vital process, to check and certify the integrity of the publication's circulation methods and claims, requires a strict and continuing audit of each publication's success in meeting this test of its public acceptance. To that essential function the ABC has contributed mightily by the conscientious performance of its mission. And that is why we are able to have a press supported, for the most part, by advertising revenues, but not controlled as to its circulation or content by any influence other than its readers.

When an advertiser consults the ABC statement of a publication to ascertain the amount, the quality and the trend of its circulation, he does so in the legitimate pursuit of his own interest. But at the same time, inevitably, he is helping the ABC to keep the press responsible and responsive to the reading public. For, in effect, he is asking the publication to demonstrate through its circulation figures that it owes its standing to a voluntary demand by its readers.

SO THE Audit Bureau of Circulations, by auditing and certifying paid circulations, has come to perform a vital service to the readers of this magazine and of every other member publication. And in performing that service, it helps to maintain in our country a press that is answerable to the reading public and to it alone. So long as the practices and principles for which ABC stands continue to prevail in American publishing, we shall find in it a sure support for a truly free press, responsible only to the public it serves.

McGraw-Hill Publishing Company



NPB Electri-Centers blend into surroundings naturally, don't have that "electrical look." Wireway extensions replace exposed conduit pipes on wall leading from ceiling to panel cabinet. Column may be extended to floor if desired.



Slim dimensions make it easy to install NPB panels where wall space is limited or not available. They slip easily inside a standard 8" H-beam, fit snugly because of rounded corners. Front overlaps back for deep recessing.

LIGHTING PANELS CAN BE ATTRACTIVE

No maze of conduit pipes or cables leads into these lighting panels . . . and they are easier to put up!

BullDog NPB Electri-Centers eliminate time-consuming bending of pipes to fit panel knockouts, and pulling of wires down through conduit pipes. All wires, from ceiling to panels, drop free in wireway extensions. Neutral wires attach to neutral bar in Pull Box at ceiling (or in false ceiling), eliminating individual neutral wires down to cabinet. Pushmatic® circuit breakers, interchangeable from 15- to 50-amps., make NPB Electri-Centers® compact, versatile.

Use NPB Electri-Centers for any commercial or industrial surface-mounted lighting-panel installation up to 32 circuits. They get rid of "open-plumbing look" in offices, hallways, factories and shops. Mount easily against walls, on columns, or in H-beams. Streamlined for appearance and safety; no sharp corners to snag, scrape or bump. Finished in beautiful gray enamel, or may be painted to any color scheme.

For easier, quicker lighting panel installation, investigate NPB Pushmatic Electri-Centers. See your BullDog Distributor, or write direct for fact-packed NPB Bulletin.

BullDog Narrow Column (NPB) Pushmatic Electri-Centers make attractive lighting panels; give easier, quicker installation; eliminate unsightly conduit pipes and cables.

NPB FEATURES ARE YOUR ADVANTAGES!

- NPB's are only 6½" wide, 6½" deep. Come in 16-, 24-, and 32-circuit capacities. Listed by Underwriters for 1 ph., 3 wire, a.n., 120/240V A.C. or 3 ph., 4 wire, a.n., 120/208V A.C.
- Wireway extensions reach to ceiling or false ceiling regardless of height, or to wiring in truss-constructed buildings.
- Lightweight, easy to handle; no loose parts to misplace.
- "Open-plumbing look" eliminated with wireway extensions.
- Numbered wire retainers are attached to back of box for circuit identification. All wiring, including main lugs, can be done before interior is installed.
- Attractive, interchangeable BullDog Pushmatic Circuit Breakers make NPB Electri-Centers compact, versatile.
- All copper current-carrying parts silvered for greater conductivity.
- Sell for price of ordinary panels; much cheaper to install.



BULLDOG

BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

PIONEERS IN FLEXIBLE ELECTRICAL DISTRIBUTION SYSTEMS

1902-1952 . . . SERVING INDUSTRY FOR 50 YEARS WITH FINEST ELECTRICAL PRODUCTS

Washington Report

Metals outlook for 1953 is bright. According to current forecasts, steel supply will balance demand by second quarter of 1953 or sooner. Copper supply is now in balance with foreseeable demand, should remain that way through 1953. Aluminum is now in approximate balance, and new capacity should increase supply substantially next year. Tin, lead and zinc are in ample supply. Demand for alloy steels, still relatively tight, is dropping sharply. Most critical alloying elements now are: cobalt, columbium, molybdenum, nickel and tantalum, with tungsten still tight.

Record-high steel production following the mid-year steel strike is rapidly eliminating steel shortages, except for wide flange structural, nickel-bearing stainless, plates, and carbon and alloy bar and seamless tubing, which are supposed to remain tight into 2nd quarter of 1953. Under consideration at NPA is a possible "open-end CMP" for specific shapes and forms of steel not in big demand, for 1st quarter.

NPA copper allocations to brass and wire mills for October were 118,481 tons, down from 125,000 tons monthly in 3rd quarter. Monthly average from August 1951 to June 1952 was 106,000 tons.

First quarter 1953 CMP metals allotments have been announced by DPA. Allotments of copper and aluminum equaled or exceeded 3rd quarter rations to all users, while steel rations to civilian and defense-supporting programs are now based at 60% of 3rd quarter 1952 allotments. Atomic and military programs received full steel allotments.

A new priorities assistance form. NPAF-138 revised, has been announced by NPA for use by an individual, firm or institution for special situations where delivery of material earlier than normal is required. Copies are available at Dept. of Commerce field offices and NPA, Washington, D. C.

August construction totaled \$3,152-million, highest monthly dollar volume on record, 10% above August 1951. Physical volume was about the same as August last year. Of this total \$2-billion was privately financed, balance was publicly financed work.

Home building in August was down 5% from July, with 99,000 starts on new dwelling units, but was up 11% over August 1951.

Revocation of Regulation X in September will boost home building only mildly, most experts predict. But it may spur commercial building, as steel supply increases. Reg. X required 50% down payments on commercial buildings, which had dropped more than a third from last year.

A study of available markets when defense production levels off has been authorized by Commerce Secretary Charles Sawyer, to give added emphasis to development of the field of distribution.

Reorganization of defense agencies to meet reduced budgets and provide more efficient handling of priorities and controls has been under way since July, will probably become a continuing activity in the months ahead as industry consultants return to industry, and need for controls diminish. New administrators now range from top agencies down to Bureaus, Divisions, Branches and Sections, with consolidation of many smaller groups into larger groups whenever practicable.

Current guess is that NPA will continue much as at present until year-end, with gradual withdrawal of industry divisions back into their normal places in the Commerce Department as need for their functions decrease.

FOR Greater Dollar Value LOOK TO ANHYDROPRENE CABLES

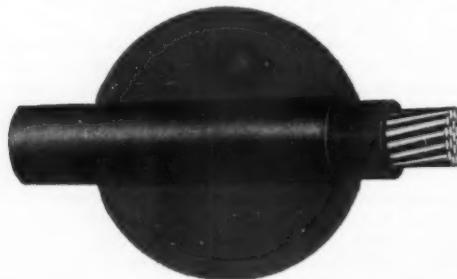
Do the high costs of materials and labor that exist today make you hesitant about buying the power cables you need? Then why not learn now how Anhydroprene cables can increase the value of each dollar you spend.

The simple 1-2-3 Anhydroprene construction consists of copper conductors insulated with the famous Simplex-Anhydrex compound, and a protective jacket of Neoprene. This Anhydrex-Neoprene combination assures long life with trouble-free service — the thrifty solution to problems of installation where ordinary cables now demand important dollars for repairs and eventual replacement.

Anhydroprene cables may be used for signal, control or power circuits. They may be installed underground in ducts. Within buildings they may be installed in conduits or raceways, or racked on walls.

Get acquainted with Anhydroprene today and you will realize greater savings from your future cable investments.

Write for Bulletin No. 115, an informative bulletin describing Simplex-Anhydroprene Cables.



Simplex - WIRES & CABLES

SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET,
CAMBRIDGE 39, MASS.

OCTOBER . . . at a Glance

DC Power

What to do for dc power requirements where changeover leaves dc apparatus which must be kept in service for an indefinite or a planned amortization period? This kind of problem is common enough, but we think you will find Consulting Engineer Richard C. Kleinberger's approach and solution to dc requirements at the Myrick Bldg. in Springfield, Mass. (page 98) both well planned and ingenious. A battery of selenium (dry plate) rectifiers do the job with a current sensitive relay circuit which automatically connects only the apparatus needed for the load. The story plan, presenting first the engineering analysis, then the actual job is Joe McPartland's idea. We think you will find it particularly interesting reading.

Small Motors

To drive the many thousands of machines which need comparatively little power, fractional horsepower motor applications are found in ever increasing abundance in industry today. Many types are available, each with characteristics particularly suitable for certain fields of application. A series of two articles "Application of Small Motors" begins in this issue (page 106) by T. E. M. Carville of Westinghouse which reviews the essential characteristics and purposes of fractional horsepower motors and their proper application.

Square Raceways

When the ultimate wiring requirements are hazy, speed the essence and copper short, maybe the familiar 4 by 4 wireway is your answer. It was for Bruno Barth of San Diego, faced with an urgent conversion job to

meet a defense contract. Parallel runs down both sides of the production area were tapped for light and power as equipment was located and production lines jelled. For the story see "Square Raceways—An Answer for Flexible Wiring" on page 102.

Spare Parts and Standby

At the Kaiser Steel plant, Fontana, Calif., a standard study procedure assures a well-balanced maintenance inventory of spare parts and complete standby units. How this procedure relates electrical maintenance needs to the inventory of maintenance supplies is described in "Spare Parts vs. Standby Units", on page 104. The story presents an orderly method for inspecting electric machine motors to determine the required stock of spare parts, analyzing when and how failure might occur, estimating "down-time" for repairs and setting up maintenance charts which guide the overall analysis for a balanced supply of spare parts and standby units.

ABC

This magazine is a member of the Audit Bureau of Circulations, which means that it is sold to you at the published price, that all records pertaining to those sales are subject to a periodic independent audit, and a detailed summary of the information is published for the critical examination of anyone interested. That's swell, sez you, for media buyers, account execs, and ad managers, but what's it to me, the subscriber? It just makes you the boss! It means that with audited paid circulation, the editors are not only responsive to what you want in your magazine, but alert to every opportunity to make it better. Be sure to read "The Reader—His Mark" on page 73.

DATES AHEAD

International Association of Electrical Inspectors—Southern Section, Hermitage Hotel, Nashville, Tenn., October 13-15.

Electrical Industries Show—Sponsored by the Eastern Electrical Wholesalers Association, 69th Regiment Armory, New York, N. Y., October 21-24.

National Farm Electrification Conference—Hotel Statler, Detroit, Mich., October 20-21.

National Industrial Service Association—Southeastern Chapter meeting, Miami, Fla., Oct. 24 and 25.

National Electrical Manufacturers Association—Haddon Hall Hotel, Atlantic City, N. J., Nov. 10-13.

American Institute of Electrical Engineers—Winter general meeting, New York, N. Y., January 19-23.

Plant Maintenance Show—Public Auditorium, Cleveland, Ohio, January 19-22.

National Electrical Manufacturers Assn.—Edgewater Beach Hotel, Chicago, Ill., March 9-12.

Industrial Electrical Exposition—Sponsored by Essex Electrical League, Terrace Room, Newark, N. J., March 10-13.

Edison Electric Institute—Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 30-April 2.

Chicago Electrical Industry Show—Sponsored by the Electric Association and the Electrical Maintenance Engineers of Chicago, Conrad Hilton Hotel, Chicago, May 11-14.

National Fire Protection Association—Edgewater Beach Hotel, Chicago, Ill., May 11-15.

National Industrial Service Association—Annual convention, Hotel Statler, New York City, May 24-28.

National Association of Electrical Distributors—45th annual convention, Conrad Hilton Hotel, Chicago, Ill., May 24-28.

Edison Electric Institute—21st annual convention, Atlantic City, N. J., June 1-4.

Illuminating Engineering Society—Hotel Commodore, New York, N. Y., September 14-18.

International Association of Electrical Inspectors—25th Jubilee meeting, Edgewater Beach Hotel, Chicago, Ill., September 21-26.

Industrial Electric Exposition—Hotel William Penn, Pittsburgh, Pa., October 6-8.



DIRECT BURIAL



OVERHEAD



IN DUCTS

Low-cost way to hit the **high** and **low** spots—

use All-Purpose **DURASHEATH**

DURABLE DURASHEATH* can be used for every type of power and lighting application up to 15kv**. The most important fact about this all-purpose cable is that it may be run *overhead*, *buried directly underground* and run *in ducts* in one continuous length. Expensive splicing is avoided. Durasheath eliminates sheath electrolysis. It effectively resists condensation, weathering, sunlight, organic decay, abrasion and mechanical injury.

You can look for *three* definite savings with Durasheath. It costs less to install. It is flexible and light. It

lasts longer. Its special neoprene jacket is tough enough to stand up to every natural enemy of cable life. It simplifies stock inventory. You need purchase only *one* cable—versatile Durasheath—to meet every electrical distribution requirement.

Ask your nearest Anaconda Sales Office or Distributor for the whole story on Durasheath. Then convince yourself how much you will save by using Durasheath. Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

*Trademark 55369B

the right cable for the job **ANACONDA®**

available in all sizes—
from large to small—single
and multi-conductor.

for traffic control, airport
power and lighting, mines,
industrial plants, railroads,
street lighting, and many
other uses.



wire and cable

†when ordered to CAA Specifications L-824.

**for voltages over 5kv consultation with Anaconda Engineers
is recommended.

Who's to Sell Light

THE CONTRACTOR'S IMPORTANCE in the development and progress of modern lighting is now pretty well accepted. New schemes and devices to subordinate his role or by-pass him in one way or another are occasionally dreamed up. But they usually run foul of an elementary principle. Useful light is produced by a collection and assembly of parts, components and wiring, involving engineering, skilled installation and efficient connection to an energy supply. And that kind of work takes our electrical contractor or an unusually good facsimile thereof.

TRENDS IN THE APPLICATION OF LIGHT are heading toward more of the recessed and the built-in, away from the attached or hung luminaire. More critical layout, better craft coordination, more exacting workmanship are required. Still more responsibility falls upon the electrical contractor for the ultimate lighting result.

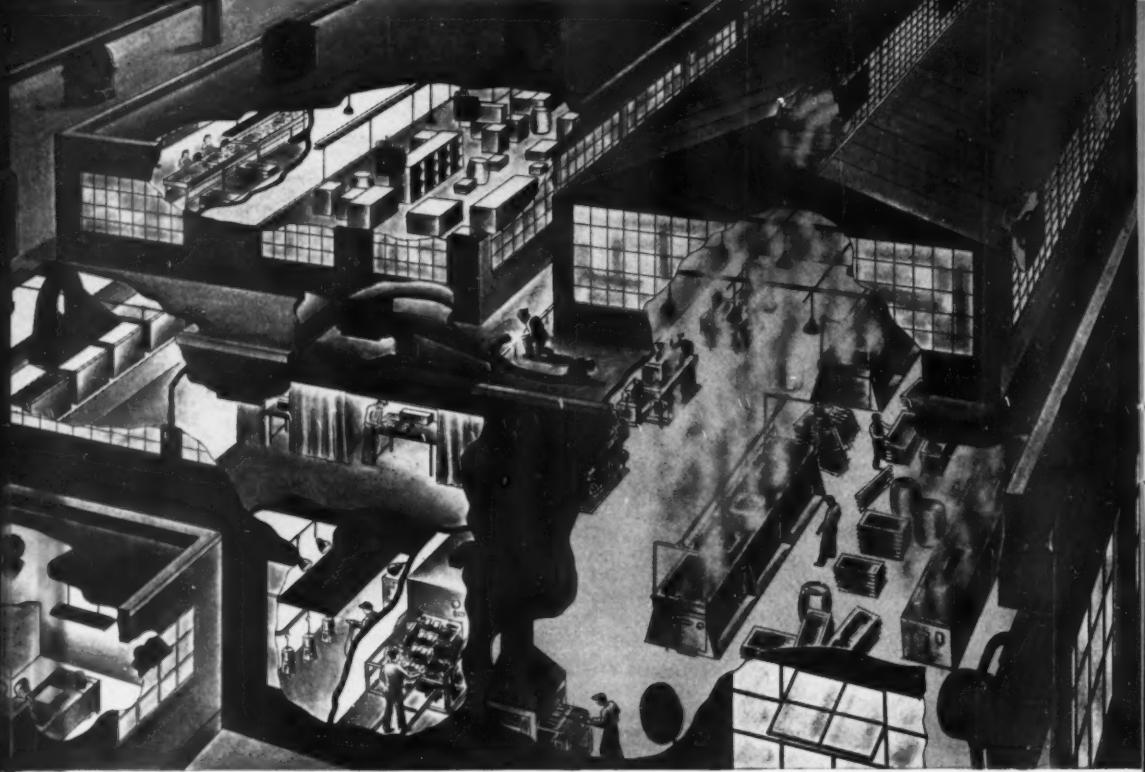
KEY MAN IN LIGHTING HE MAY BE, but is the electrical contractor the most effective salesman for the lighting industry? We ask this question because it has been kicked around in industry circles for years. To us the answer is obvious. He is. What's more, he **must** be. At the threshold of the market he takes the order, delivers the package and collects the money. And what that package contains are the going standards and the current effectiveness of the engineering and sales efforts of all the lighting industry.

THE GREAT BENEFITS of modern lighting eventually have to run up against the realities of the marketplace. All of the sales efforts and influences must come to focus on a plan and a dotted line. At this crucial point, is the contractor confident in his technology, backed by all elements of his industry, supported by strong sales aids and by national and local promotion? If not, then why not?

THE JOB IS THE PAY-OFF of lighting sales. The contractor, the wholesaler, the manufacturer, the utility and the public share in the practical proceeds for better or worse. So, the success or failure of any course of lighting development or any plan of lighting sales is eventually determined by the sales effectiveness of a particular electrical contractor on a particular job.

WHEN IMPORTANT NEW BUILDINGS fall short of accepted standards of illumination, when little modernization jobs show feeble compromise with good lighting techniques of known and established value, they are failures for the whole lighting industry. Who's to sell? The electrical contractor will. He must. Will he have the confident support and backing of all the electrical industry? The answer to that question is going to determine the pace of lighting progress from here on.

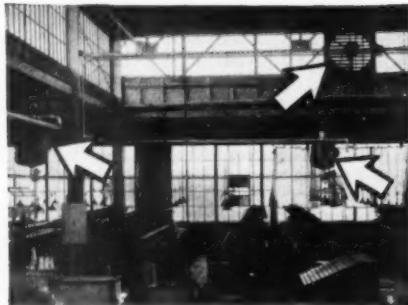
Wm. T. Stuart



ILG UNITS FOR EVERY VENTILATION NEED. Portable floor fans for spot cooling . . . circulators and window ventilators for offices . . . self-cooled propeller fans and universal blowers for large-volume circulation — there's

a standard ILG unit designed to provide efficient flow of cool, refreshing air wherever it's needed. And, you'll find them all conveniently available through your nearby Graybar office.

Put fresh air to work for your customers



Unit heaters, infra-red drying units, and accessories, too, are distributed by Graybar. Combined with an efficient ventilating system, you can provide for even heat distribution during cold weather. Your Graybar representative will be glad to furnish accurate information to help you prepare bids and work out practical job time tables.

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LIGHT

CHALLENGE OF THE FIFTIES

Analysis of lighting markets, techniques and sales methods reveals need for a nation-wide relighting program with emphasis on lighting sales by electrical contractors.

LIIGHT is radiant energy which permits vision. Without light people cannot see. But with plenty of light of good quality, people *can* see, and with comfort. Light is among the most important commodities in the world today.

An analysis of the lighting industry's market pattern over past years reveals some inherent market weaknesses and instability. Estimate of the future market, short range, indicates continued growth at average growth rate for another two or three years. But the estimate long range, over the next ten to twenty years, indicates a need for new and expanded lighting markets to permit the industry to maintain even its normal growth rate. These markets will be needed by all branches of the industry—lamp and lighting equipment producers, electric power companies, distributors and electrical contractors.

Further analysis of lighting markets shows that a new market does exist, now, for all types of lighting systems and equipments. It is the relighting market. It is nation-wide. It exists in every community—in homes, factories, offices, schools, stores, and public and private buildings of all types.

This relighting market can and must be sold. People need more and better light, and the industry needs the business. The relighting market will be sold, and in one of two ways. Either it will be sold haphazardly, hit or miss, at below present day standards and lighting know how; or it will be sold intelligently and efficiently through a coordinated industry wide program in which electrical contractors will spearhead this activity through their own initiative and qualified leadership. Contractors already have the organization, tools, manpower and contact with these relighting prospects necessary to do the complete job. But they need and deserve the intelligent and effective backing of all other branches of the industry.

There is no other logical approach for selling

this relighting market. Manufacturers don't have the sales manpower. Utility companies can provide invaluable engineering and sales assistance, but don't have adequate personnel nor the installation mechanics to do the job. Electrical distributors can help contractors in many ways, but cannot devote the time and effort of their salesmen to sales promotion work at the user level, nor can they sell more than just the materials. Only the contractors are equipped to do the entire job.

Light is the challenge of the Fifties. It is not only a challenge, it is an opportunity. And the big opportunity is relighting, and a new concept of the art of selling.

Light is produced and sold as a commodity, or commercial product. Light is the business of the lighting industry. The demand is almost limitless. It is needed wherever people live, work or play. It is essential for their health, happiness and prosperity.

Light sources and lighting equipment are the physical devices which are produced and sold by the lighting industry to provide the ultimate commodity—light. Between the design and production stage of these devices, and their eventual application and use to provide light as a less tangible commodity, the ultimate objective of their production and sale is often neglected and forgotten. All too often the objective becomes the production and sale of the devices as so much metal, glass and plastics. The market for these devices as such is almost non-existent. But the market for light, and for the benefits of modern lighting technology is so enormous as to preclude reasonable appraisal.

Outlined in the following pages is a detailed analysis of the future lighting market, a review of modern lighting techniques and trends, and a step-by-step procedure for electrical contractors who want to develop a more effective and aggressive sales-getting lighting program of their own.

Lighting Market Outlook

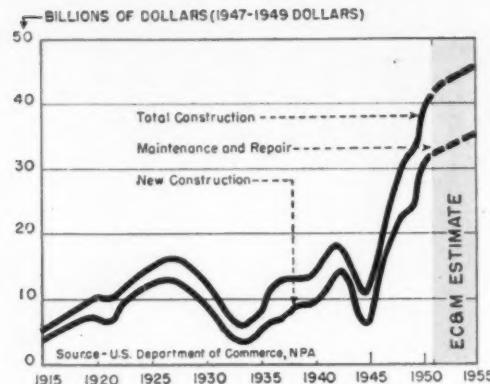


CHART I—Total Construction Volume

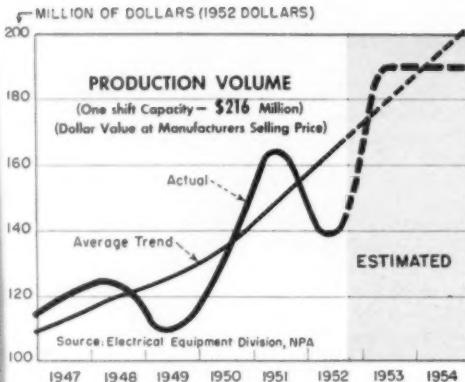


CHART IV—Fluorescent Lighting Equipment

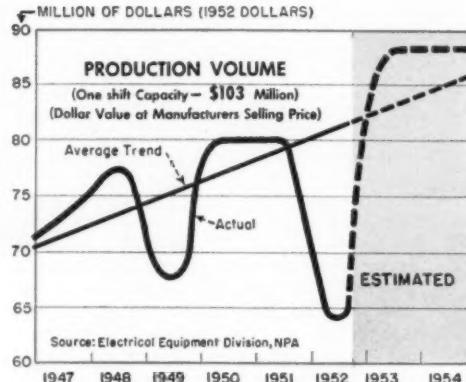


CHART V—Incandescent Lighting Equipment

YEAR after year lighting sales constitute an ever increasing percentage of the electrical construction market total. This percentage increase has been at an even greater rate over the past thirteen years, since the introduction of the fluorescent lamp, and the demand for higher and higher intensities of light. The annual lighting sales volume, plus the related wiring and installation business it supports, has grown to such proportions that no electrical contractor, small or large, can afford to ignore it.

Where is the market for lighting sales now headed? What is the market outlook, in the immediate future, and long range? For a sound analysis, it is necessary to study the many factors which influence lighting sales, both historically and as they may be expected to apply in the future.

Some of the major factors influencing lighting equipment sales include: 1) new building construction; 2) modernization of existing structures; 3) electric power generating capacity; 4) economic outlook; and 5) lighting industry promotion efforts. There are many other factors, but the five listed are considered to be of primary influence.

Lighting Equipment Production

Historically, the lighting industry has been growing at a rate of about 4% each year, over the past ten years. There are no statistics on total lighting equipment sales to ultimate consumers at users' cost. However, lighting equipment manufacturers have been required to report production and shipment totals (at manufacturers' selling prices) to the National Production

Authority under the Controlled Materials Plan, in order to obtain their allotments of steel, copper and aluminum, and their authorized production schedules. These production statistics provide the only known reliable historical information on the total lighting industry volume, and are used for this study.

Only those classes of lighting equipment normally sold and installed by electrical contractors are considered in this study, and include: 1) fluorescent lighting equipment; 2) incandescent lighting equipment; 3) street and highway lighting equipment; and 4) airport, marine and floodlighting equipment. The study does not include such equipment as residential portable lamps, aircraft or automotive lighting equipment, sign lighting, or other specialized lighting equipment.

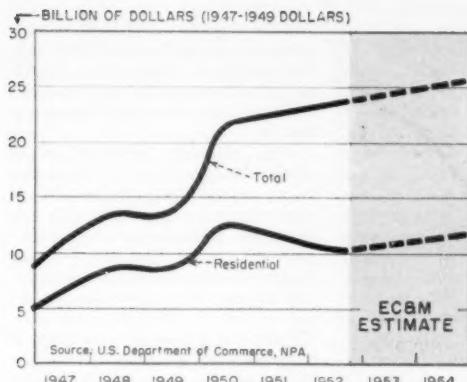


CHART II—New Construction Only

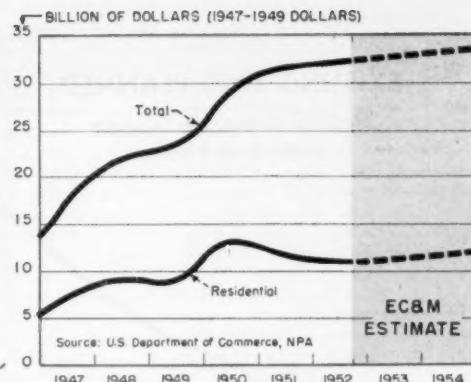


CHART III—New Construction Requiring Lighting

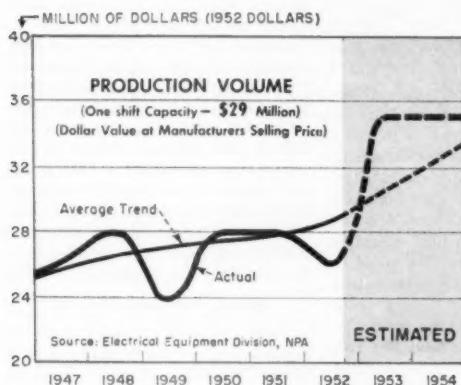


CHART VI—Airport Marine, Floodlighting Equipment

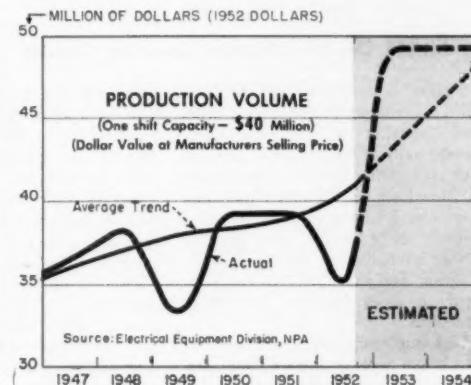


CHART VII—Street and Highway Lighting Equipment

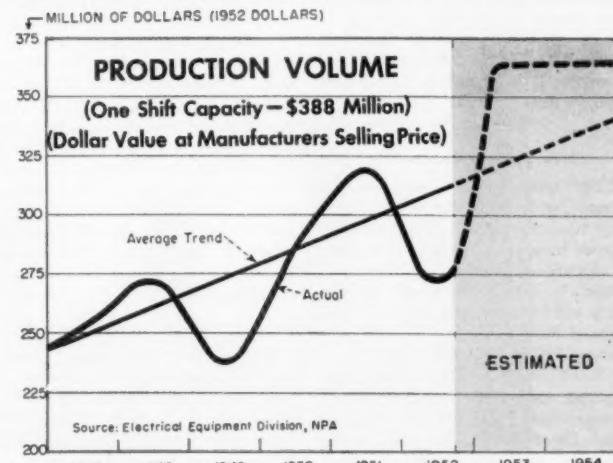


CHART VIII—Total Lighting Equipment Volume

Actual lighting equipment production shown in the Charts on these pages, shows a dip in production in 1949 and in 1952. The 1949 dip is attributed to production in 1948 at a rate in excess of normal demand. Inventories piled up in producers' warehouses and in distributors' stocks. Thus producers cut back on production in an effort to clean out inventories. The sales curve was then lagging production by from six to twelve months. During this period of high inventories both producers and distributors cut prices to the bone in an effort to further reduce inventories and convert them into cash. It was at this period that the Korean crisis began, in mid-1950.

The 1952 dip in lighting equipment production was brought about by three principal factors: 1) material

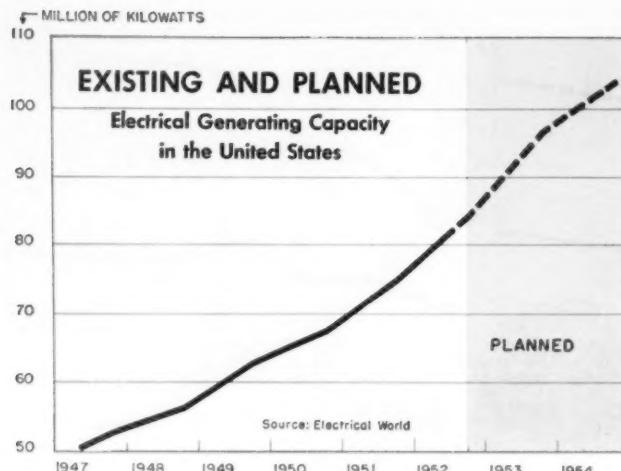


CHART IX—Total Electrical Generating Capacity

shortages, especially copper; 2) slowdown in construction due to steel strike and shortages of structural steel, thereby causing stretch-out of delivery time on lighting orders on hand; and 3) slowdown in lighting equipment sales, due in part to rigid construction controls early in the year, part to further stretch-out of the mobilization program, and part to a deep retrenchment in modernization of existing structures.

Lighting equipment production has now begun another upward climb, and by mid-1953, according to current NPA estimates, will hit a new peak. This new plateau is expected to be maintained through 1954, to meet normal defense construction programs already approved and under way, and normal residential, industrial and commercial construction at current going rates.

New Building Construction

The lighting of new structures accounts for a major part of total lighting equipment sales. The percentage varies from year to year, and no statistics are available to show the breakdown. It probably has ranged between 50% and 75% over the past five years, around 50% from 1947 to 1950, and around 75% in 1951 and 1952.

New building construction requiring lighting equipment (excluding heavy construction) has steadily increased (see Chart III). This construction includes residential building, which currently represents about one-third of the total construction dollar vol-

ume and provides a low potential for lighting equipment sales per dollar of construction as compared with commercial or industrial construction. Over the past five years the ratio of industrial and commercial construction to residential construction is increasing, and construction estimates through 1954 maintain this trend.

Even if new building construction maintains its present going rate through 1954, which seems a reasonable assumption at this time, this volume alone is not adequate to maintain the normal lighting equipment sales pace established over the past five years. To maintain this pace, sales must be increased about 8% annually, and even if every new job is sold "up" to reflect average technological progress, new construction installations alone will not support the lighting industry's average market growth rate. New lighting markets must be found. The industry's experiences post-War II point up this fact effectively. Present production capacity on a one-shift operation is about 35% above the 1952 rate of production, and additional capacity is being added. The logical answer, the *only* answer, is to *sell more* relighting jobs.

Modernization

Today's relighting market is conservatively estimated at over five billion dollars. (See Chart X.) This amounts to only about 25 cents per square foot for the approximately 20 billion square feet of floor space involved in the 4.5 million establishments. With modern lighting installa-

tions now selling for from 50 cents to three and four dollars per square foot, the five billion dollar market estimate would probably result if one establishment in five is sold an adequate relighting job.

This relighting market CAN be sold! It is logically a job to be tackled by the entire lighting industry. All industry branches benefit by each sale made, and should therefore jointly promote this market. The main responsibility, however, rests squarely on the nation's electrical contractors. Every one of the 4.5 million business establishments is already the customer of some electrical contractor. That fact alone puts the contractor in the key position of already having an established contact and business relationship with the customer. That is the biggest single factor in developing each business establishment into an interested lighting prospect, and then into an ultimate lighting customer. Further, the contractor benefits most from each job sold. He gets the entire order for all lighting equipment involved, plus the order for all related wiring and installation. The wiring and installation business generally equals that of the lighting equipment business, thus making this relighting market total about \$10-billion worth of business for the contractors.

Electric Generating Capacity

Total generating capacity of all the nation's electric utility plants is now about 79 million kilowatts, with an approved expansion program underway that will boost the total to over 103 million kilowatts by the end of 1954. Just five years ago, in 1947, total generating capacity was only 50 million kilowatts. Thus in seven years the capacity will more than double.

To the lighting industry, this added power capacity has special significance. It means that electric utility companies will soon have excess generating capacity available, and will again promote markets for electric power. Lighting will come in for its share of stepped-up promotion by these companies. This activity can and will exert a tremendous influence on the market for relighting. Electrical contractors will be urged by the electric utilities to tie in with this activity. Contractors who begin planning now to effectively promote lighting will benefit most from this utility activity.

Economic Outlook

U. S. industrial expansion has been vigorously promoted by defense mobilizers and Washington planners since

the Korean crisis erupted in mid-1950. Total value of new defense and defense supporting plants and equipment completed or under construction now totals \$21.3-billion, with another \$8-billion expected to be added over the next few months. This expansion has been principally in basic industries, and is production capacity that will serve either arms-production or peace-time production, or both. While mobilization officials have crusaded for this expansion, it has been individual businessmen who have made the decisions to carry out the expansion.

What happens next, when this expansion is completed and put into operation? The answer insofar as future expansion is concerned will depend on businessmen's own estimates of future consumer demand. As for post-mobilization consumer markets, for all types of products, the answer depends on how much can be sold, not how much can be produced. With increased production capacity in operation for all types of products, highly competitive markets lie just ahead.

The lighting industry has already suffered one severe inventory glut post-War II, the one in 1949-50, and one mild over-production period this year. Its estimated capacity at present, based on one-shift operation, is \$388-million annually, with additional capacity being built. This compares with \$800-million production for 1952.

The two markets for lighting sales are 1) new building construction, and 2) modernization. Only minor increases in lighting sales may be expected from new building construction through 1954. What happens beyond depends on how well new building construction holds up, which in turn will be influenced by many economic factors. Some economists are predicting "the greatest era of prosperity we have ever known—with the highest standard of living yet seen." But even if new building construction continues to climb after 1954, this market will not satisfy the needs of the lighting industry since it, too, must maintain an already established annual growth rate in order to maintain normalcy.

Increased lighting sales in the modernization field thus becomes a paramount necessity in order for the lighting industry to maintain its economic health. That includes all segments that produce, sell or install lighting equipment. And if it is to continue to grow, this increase in modernization lighting, or the relighting of existing establishments, must be stepped up very considerably. This means that much more emphasis must be placed on the small relighting jobs, those jobs requiring from six to 50 luminaires each, as well as the larger jobs of 50 to 100 luminaires each and over.

Consider another economic possibility. In his Midyear Economic Report, President Truman reported that

the U. S. is experiencing unbounded prosperity, and predicted that total output, which was \$300-billion in 1950, is now \$340-billion, should reach \$440-billion by 1960. His Council of Economic Advisers, however, in their Economic Review on which his report was based, reported the economic stability as "uneasy," and pointed out that most of the increase in output during the past year was used to meet government and business demands associated with the national security programs. Cutsbacks in military appropriations after 1954, based on CEA's report, would therefore inferentially remove a prop from the present apparently "strong" economy.

Lighting Promotion

Total lighting industry sales can be upped through lighting promotion done on a continuing and industry-wide basis. Just how much the lighting industry should invest in promotion in time, money, and effort depends on the existing market potential for increased sales. Any increase over the established normal growth rate of sales can be tabbed as "plus business."

While contractors might do an effective job of lighting promotion on their own, best results would be achieved through an industry wide promotion program. Details of a suggested program of this type are given on page 88, titled "Needed—An Industry-Wide Lighting Program."

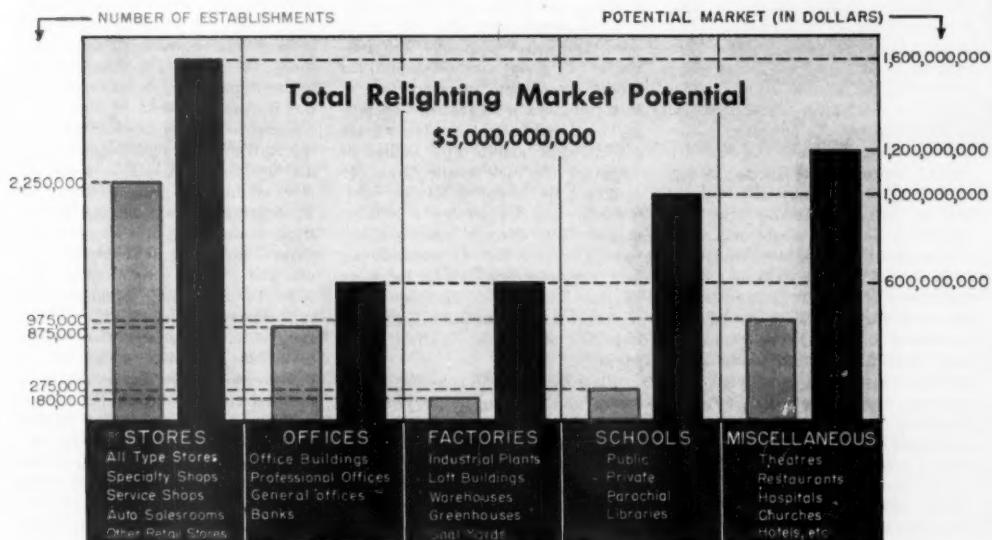


CHART X—1952 Relighting Market Potential in the United States

Take These Steps
To Increase Your
Lighting Sales

- Step 1. Develop Your Own Lighting Program**
- Step 2. Estimate Your Lighting Market Potential**
- Step 3. Set Up a Lighting Promotion Activity**
- Step 4. Organize a Lighting Sales Department**
- Step 5. Provide a Design and Layout Service**
- Step 6. Set Up a Lighting Installation Department**
- Step 7. Put Your Lighting Program To Work**

How You Can Sell More Lighting

EVERY electrical contractor can increase his lighting sales. The market exists. The market potential is fantastically staggering. Based on estimated total lighting equipment sales for 1952, if every electrical contractor in the United States increased his lighting sales 15% each year over the preceding year, for the next ten years, the present relighting market would still not be completely sold. At that geometric progression rate, each contractor in 1962 would sell about four times as much lighting equipment as he did in 1952. The existing relighting market is conservatively estimated at over five billion dollars, for lighting equipment alone. Lighting equipment sales in 1952 will total about \$300-million, and is predominantly for new building construction. Further, the relighting market is now growing at an annual rate about equal to all lighting sales each year.

How can electrical contractors efficiently sell this relighting market? What are the incentives? Why should contractors bother with it?

Electrical contractors can sell the relighting market efficiently by 1)

analyzing and studying the market—where it is, number and type of prospects involved, and what has to be done to convert prospects into customers; 2) giving consideration to the setting up of a lighting program in each contractor's organization—a program tailored to the individual market potential and contractor's method of operation for each market area; 3) assigning the responsibility for lighting sales and for putting a lighting program into effect to some qualified lighting man; and 4) streamlining their existing organizations for more efficient handling of lighting sales, engineering and installation. Suggested steps are outlined in detail in these pages.

While the electrical construction industry is a growing industry, and is predicted to continue as such for several years, the fact remains that competition is getting keener all the time. This is especially true on new building construction work, and on specification bid projects. Relighting offers an alternate market for electrical work, at a reasonable profit, usually "out of competition". In relighting, the big

market is in smaller jobs. These are the jobs, requiring from five to 100 luminaires each, which are out of competition. The contractor has an opportunity to sell the job, install it, and go on to the next job before competition learns about it.

Someone is going to sell this relighting market. Lighting equipment manufacturers must have this added volume to maintain their own growth. This market logically belongs to electrical contractors in the established chain of distribution of electrical products and services. Producers and distributors of lighting equipment and components and electric utility organizations have done and will continue to do an aggressive sales job. But their work must be supplementary to the contractors' sales effort; and not a substitute for it. Modern lighting systems require modern wiring, new control methods, expert installation, and careful integration of one with the other. Contractors are qualified by training and experience, and by organization to perform all these functions. Contractors can and will accept the responsibility for selling this market.

Step 1 . . .

Develop Your Own Lighting Program

Any campaign to capitalize on the lighting market potential demands scheduled coordination of the promotion, sales and installation activities of the contractor. Any electrical contractor can meet this demand with a concentrated lighting program. With careful planning, this program can be developed as a guide to the conduct of his lighting business. Its purpose is to correlate such factors as:

- a. Local lighting market potential.
- b. Lighting promotion activity.
- c. Lighting sales department.
- d. Lighting design and layout service.
- e. Lighting installation department.

The contractor can develop a sound lighting program by appraising each of these factors in relation to his own organization. After thorough and care-

ful study of the scope of his projected lighting sales campaign, he should prepare a written outline of the various activities involved. An organizational chain-of-command must be set up to assure an efficient work procedure, with department heads assigned for promotion, sales, engineering and installation. This personnel framework depends, of course, on the size of the organization; and responsibility for more than one department can be assigned to a single person. However, the duties of each department should be outlined in detail as separate, complete functions.

In its final form, this written outline should be made up as a lighting program chart which will provide the contractor with a clear, overall



A LIGHTING PROGRAM tailored to serve this electrical contractor organization is outlined to its president (left) and treasurer (right) by the lighting specialist.

picture of his lighting campaign. It should be a flow-chart for handling any lighting job from the prospect stage to the satisfied customer. And as his lighting campaign develops, the contractor should make such program revisions as experience dictates. Like no other selling job that confronts a contractor, selling lighting depends upon a well-balanced program.

Step 2 . . .

Estimate Your Lighting Market Potential

Sales planning can be no better than the data on which it is based. Thus, in order to set up an effective lighting sales program, a contractor should estimate the total lighting market potential in his area of operation as accurately as possible. This market potential should include lighting for both new building projects and modernization or relighting jobs.

Past activity on new building construction, plus any known factors which will affect new construction in the area in the future, will give a reliable guide to the volume of new building lighting.

The relighting market for a community of 25,000 or less population can be estimated fairly accurately, and without too much trouble and effort. An easy approach is to prepare a list of the types of establishments in the community, then under each type list the names of all establishments in that classification. Next list the value of a modern relighting job opposite the name of each establishment, based on the approximate cost per square foot for good lighting jobs being sold in the area and an estimate of the size of each establishment.

For example, "banks" would be one type of establishment, and there

might be 15 banks in the community. Five of these may have been lighted within the past four or five years, and therefore would not be considered as likely prospects for relighting. But the other ten banks would each represent a relighting market potential. This potential should be estimated along the lines suggested above, as accurately as possible.

The total of the estimates for relighting each type of establishments provides the total relighting market potential for the community.

With an estimated relighting market potential for the community, the next step is to estimate how many of these establishments can be sold relighting, if *actively promoted*. If there are other electrical contractors in this community who may also actively promote relighting, each contractor must also decide what percentage of the total he will get. This estimated volume for relighting plus his estimate for lighting in new buildings provides a contractor with his total lighting market potential.

In a community of 25,000 population, the average relighting potential is about \$1-million, and might run as high as \$5-million, for lighting equipment only, if properly promoted.



LOCAL LIGHTING MARKET potential, estimated by the lighting specialist (right) is reviewed by the company's president.

In larger cities and metropolitan areas contractors can obtain assistance in making their estimates of the potential relighting market from local electrical industry groups, such as the electric utility company, lighting distributors and lighting equipment manufacturers' representatives; also from the Association of Commerce. They can also use the classified section of the telephone book to determine the number of establishments of the various types, then use an estimated average dollar value for relighting the average establishment of each type. For the purpose of this survey, such estimates may be considered reliable.



LIGHTING PROMOTION IDEAS are studied and analyzed by the lighting specialist and company president.

Literally hundreds of relighting prospects are waiting to be developed into customers in every electrical contractor's territory. But the contractor wants the answers to some very pertinent questions before he makes any attempt to establish a lighting promotion activity. For example, he wants to know how he can reach these prospects quickly and inexpensively. He wants to know how much he can afford to spend on promotion in developing these prospects into potential customers. He also asks if he should bear the cost of promoting this market alone, or should he be aided by the other branches of the electrical industry which also benefit from the promotion.

The electrical industry agrees, generally, that lighting promotion is an industry-wide responsibility. But the progressive electrical contractor does not have to wait for an industry-wide lighting program to be organized and put into operation. He must keep his business growing. He needs added business now, in order to maintain his

Step 3.

Set Up A Lighting Promotion Activity

average growth rate. So his best bet is to move into this relighting market now, ahead of his competition, and start now to build up his reputation as a sound and progressive lighting contractor.

Lighting promotion goes hand in hand with lighting sales. The promotion activity is for the purpose of getting the prospect's interest, getting him to listen to the sales story. It does not have to be an expensive activity. Each contractor can best decide for himself just what type of lighting promotion will be most effective in his community, and how much he can spend based on how he operates, how many salesmen he has working for him, and how well he will be able to follow up the promotion work he does.

There are three basic types of promotion which the contractor should consider for promoting lighting: 1) advertising—an indirect method; 2) direct mail—a direct method, to a large group; and 3) telephone calls and personal calls by salesmen—a direct method to a select group. Contractors should use all three to promote lighting, to the extent that his organization and finances will permit.

Advertising. Media to be considered include the classified section of the telephone directory and other local media, such as: newspaper, radio and TV stations, outdoor signs, slides for use in movie houses, and trade magazines. The advertising budget should not exceed one percent of a contractor's total gross volume of business until he has established some measure of its effectiveness.

Direct Mail. Many electrical contractors are now using direct mail to promote their business. Techniques vary, but generally mailings are made monthly, and the mailing list usually includes architects, engineers, large industrial and commercial firms, and old customers.

Direct mail can be used to promote lighting on a more specific and concentrated basis. Special direct mail campaigns can be set up. A special mailing list should be selected for each campaign. For example, a campaign may be devoted to show window lighting, and directed to every retail establishment in the community. Or, a special campaign can be set up for relighting every drug store in a community. Local markets, size of community, and similar considerations will guide in the use of such campaigns.

Telephone calls. An ambitious and progressive salesman can effectively use the telephone to develop lighting prospects. The procedure is to select a certain type of establishment, such as "restaurants" in the classified section of the telephone directory, and call every restaurant listed. This is also a good follow-up procedure for direct mail campaigns to a selected list. In the final analysis, the success of any type of lighting promotion will hinge principally on the conscientious follow up by a well qualified and specially trained lighting salesman.

Needed—An Industry-Wide Lighting Program

THE Lighting Industry today faces a real challenge. Its production capacity exceeds its normal market, and still more capacity is being added. It must find or create new markets, or face overproduction and all the problems that go with it. New markets will permit a continued orderly growth of the industry, and encourage fair dealing on an ethical basis by and among all branches of the industry. But overproduction intensifies competition, promotes price cutting, reduces the industry dollar volume, and stifles growth.

New building construction alone will not support the lighting industry from today on. Even with continued expansion in new building construction, which many economists predict will slow down or actually diminish when defense spending is curtailed, the lighting market involved will not be adequate to maintain proposed production goals.

The lighting industry's real challenge is to develop its relighting market, the thousands of old structures up and down Main Street and in all the side streets of every city, town and village in the country. This relighting market is larger today than ever before. It has not been effectively promoted in the last 15 years. It is conservatively estimated that at least 80% of the more than 4.5 million establishments of all types are poorly lighted, and are real prospects for modern lighting systems. One recent survey made by the editors of "Electrical Wholesaling" in a typical American city of 25,000 population pointed up this fact clearly.

The lighting industry is only one of many industries now competing for the businessman's dollars. Others include air conditioning, paint, floor covering, electrical heating, furniture, machine, building materials, plumbing, store fixture, plate glass, sign, and other industries.

Step 4.

Organize A Lighting Sales Department

Lighting systems must be sold—customers don't just call up and place an order for one. They are not that kind of product. So the contractor who sells lighting must have a salesman. And it follows, logically and factually, that the better the salesman the more successful will be the contractor's lighting activity.

The salesman who sells lighting must be a special type of salesman, if he is to be successful. He must be specially trained in the fundamentals of light control and lighting application, and must also know how to sell. In effect, he must be a lighting sales-engineer, technically trained and sales trained.

Every lighting system should be custom planned for the job it is to do, tailored to the customer's needs. That requires technical knowledge and skill in the science and art of lighting. The lighting system can be designed and laid out by a lighting engineer, but the salesman who sells the job must still be qualified to appraise the engineering and design features of the system proposed, and of other possible systems and designs which might also be suggested by the customer or a competitor. Thus the salesman must be qualified to sell the lighting system proposed, the specialized knowledge and ability of the contracting organization behind him, and the benefits and advantages of better lighting. By education, training and skill the salesman is the only individual qualified to do this complete job.

Electrical contractors who own small

businesses usually do their own selling. Those who operate larger organizations usually have one or more salesmen selling their services for them. Either type of contractor can adapt his business to specialized lighting sales and installation. But in both cases, the one who does the selling should have some training in the specialized field of lighting. He should have both technical and sales training. Technical training will qualify him to discuss the whole field of scientific and engineered lighting, to appraise one lighting technique versus another, and to be thoroughly familiar with all light control principles, all types of equipment, visual environments, glare appraisal and comfort evaluations, the economics of lighting, maintenance factors and other similar considerations. Sales training will qualify him to sell in the specialized field of lighting, train him how to get the prospect's interest, and how to select and appraise the benefits and advantages of good lighting as they will apply to the individual customer.

When a contractor's business volume and expected volume in lighting, if actively promoted, is too small to justify hiring a salesman, he should qualify himself to do his own lighting sales work just as thoroughly as though he hired a lighting salesman to sell for him.

If a contractor's business volume justifies a small sales force, at least one salesman should be assigned to lighting sales and given the necessary



LIGHTING SALES PROGRAM is explained by the lighting specialist to his two energetic young salesmen.

training to qualify him for this work.

Large contractor organizations may want to give consideration to the hiring of one or more qualified lighting salesmen or lighting engineers, who already have some training and experience in the field of lighting sales and engineering work. In such cases, it is well to appoint one qualified individual as the *lighting specialist*, who will operate the lighting department, supervise lighting sales, engineering, and layout, prepare the lighting recommendations, and assist salesmen wherever possible.

While there are no yardsticks by which to measure the necessary volume of lighting sales required to justify the hiring of a salesman who would devote his entire time to lighting, every contractor can make a reasonably sound estimate of what additional business volume in lighting sales and related work would be worth to his business. Salesmen should be hired on this basis until some measure of value has been determined by experience.

Businessmen must be sold the benefits of lighting and have it proved to them that money spent for lighting will offer greater benefits than if spent for some of these competing products. That is a job for the industry as a whole. It is a job in which all segments of the lighting industry should participate. Each should do its part. It is a promotion job, a training job, an educating job, and a selling job. Not only must better quality installations using more and better lighting equipment be sold in the nation's new structures, but also in the nation's modernization of old structures. Modernizing with light is a natural. More light of better quality, properly planned for easier seeing, for greater human comfort, and for artistic and decorative effects, can serve as the real medium for modernization.

To do this job effectively, the lighting industry needs "An Industry-Wide Lighting Program." It needs a

program designed to train its own personnel in all phases of lighting design, layout, application and installation. It needs a program designed to educate its own personnel, and architects, engineers, designers, decorators and others, including businessmen who are prospective buyers of lighting equipment, to the benefits and advantages of properly designed and applied lighting systems. It needs a program that will sponsor effective lighting promotion, and make available suitable promotion material and guidance. It needs a program that will effectively promote increased lighting sales.

An Industry-Wide Lighting Program is needed to give carefully studied guidance to all segments of the lighting industry for their individual efforts in lighting promotion and lighting sales. This program should be national in scope, and participated in by all members of the industry—producers, distributors, sellers and installers



LIGHTING PLANS are prepared by a lighting engineer-draftsman (right) under supervision of the lighting specialist.

Selling lighting is a specialized job. The prospect wants a lighting result, not lighting equipment. But he must have a lighting system to provide that lighting result, and a lighting system means the purchase and installation of lighting equipment.

Selection of lighting equipment to provide a specific lighting result is a job for a lighting engineer. By experience and training he does his best thinking in terms of a "plan". He interprets lighting results in terms of lighting units, arranged in orderly patterns or located with reference to the visual task to be lighted according to principles of light control. Thus his best medium of expression is a drawing, or a "plan".

A lighting plan, which also usually incorporates the wiring plan, should form a part of every lighting recommendation. Then when the lighting and wiring systems are sold, the plan forms the basis for the lighting contract. It shows the customer exactly what he is buying to produce the de-

Step 5 . . .

Provide A Design And Layout Service

sired lighting result. The lighting plan also impresses the prospect with the fact that lighting design and layout is a technical problem, and that for best results should be done by a qualified specialist in that field. The plan makes it easier for the salesman to close the contract.

Any electrical contractor can provide a lighting design and layout service. He has three choices, or combinations of them, in setting up this service. He can 1) use "free" engineering services provided by most electric utility companies, and lighting equipment and lamp manufacturers; 2) hire an outside professional lighting consultant on a "fee" basis; or 3) have the work done in his own engineering department.

Many contractors are now using the "free" lighting design service of the electric utilities and lighting equipment manufacturers and distributors. Main advantage in this service is that it costs nothing, and the contractor can use their help in selling the job, if he wants it. Disadvantage from the contractor's viewpoint is that he limits his freedom of choice of lighting equipment and devices, in many instances, to those of a particular manufacturer.

Contractors who hire a professional lighting consultant have an added advantage in that they tie their own services in with a prestige name. There are all too few professional lighting consultants in the field. If more contractors made use of these

men, both would benefit. Contractors would sell more and better jobs, and build more prestige. The consultants would be kept busier, increase their own prestige, make more money.

Contractors who do their lighting design and layout work in their own shop have more freedom—freedom of expression for their own ideas in lighting application, freedom to select and use that lighting equipment which best solves the problem, freedom to work closely with the prospect to meet his individual whims and desires.

Contractors who make their own lighting designs and layouts need a qualified lighting engineer on their own staff to do this work. This engineer should know light control principles and be thoroughly familiar with all available types of lighting systems, luminaires, equipments and devices. This knowledge, plus thorough knowledge of all illumination design and application principles will enable him to provide lighting plans and layouts of superior design, out of range of competition from poorly planned and unimaginative designs and layouts. Better design layouts will be found easier to sell.

Regardless of who makes the plan, and on what basis, contractors who offer a lighting design and layout service will find this service works to their advantage. It will bring in prospects, build more company prestige, and generally contribute to the success of their lighting activity.

of light sources and lighting equipment and devices. It should further be designed to operate efficiently at the local level, at the point of contact with the ultimate customer. Its major emphasis should be at this local level.

This Lighting Program should be developed around a theme. This theme should be a word or a phrase which tells a story. The Planned Lighting Program, sponsored over the past five years or more by the Edison Electric Institute, provides a sound background and much valuable experience on which the proposed industry-wide Lighting Program might be based. Its theme of "Planned Lighting," or "Have Your Lighting Planned," has been highly successful in promoting that thought. "Modernize With Light" is an example of a theme which might be used now to successfully promote a relighting campaign.

Three types of lighting education should be included

in this Lighting Program: 1) Technical; 2) Sales; and 3) General (for lighting prospects). The technical lighting education should be made available to personnel of lighting equipment manufacturers, their representatives, electrical distributors, electrical contractors, electric utilities' lighting service representatives, consulting engineers, architects, designers, decorators and others who design, specify, lay out, sell or install lighting systems and lighting equipment. Lighting sales education should be provided for manufacturers' representatives, electrical distributors' salesmen, electric utilities' lighting service men, and electrical contractors. Major emphasis should be put on lighting sales education for the electrical contractors, for these are the only salesmen who are in the position to quote prices (ethically) to the lighting prospect and complete the sales transaction.

Lighting education for the ultimate consumers should be provided by this Lighting Program specifically planned

Step 6 . . . Set Up Lighting Installation Department

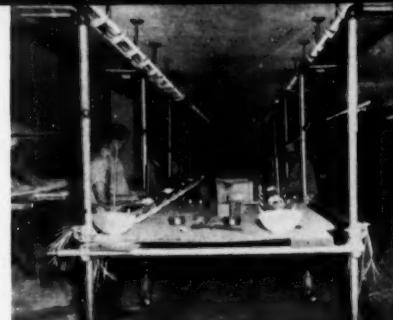
Backbone of the electrical construction industry is, and has been since its beginning, the purchase, design, sale and installation of electrical systems—wiring, controls, and utilization devices. Lighting systems are one of these utilization products; also require wiring systems and controls. Electrical contractors have installed lighting systems throughout the years, and are experts in the field—in fact, they are the only group qualified to do this job today.

So what is intended by the recommendation that contractors who set up a lighting program also establish a lighting installation department?

Specialization is as important for efficiency and lower costs in the electrical construction industry as it is in

other industries. Lighting systems are broadening into a wide range of types—luminous and louvered ceilings, combination light-and-sound systems, recessed units, etc., as well as surface and pendant mounted units. Also, wiring systems for lighting are becoming more complicated.

Electrical contractors who decide to promote and sell lighting on a broader basis will also want to give consideration to a greater degree of specialization in the field of lighting installation. What kind of tools, ladders, trucks, etc., are they now using? How can the work be done more efficiently? Should lighting installation be separated from heavy industrial and power wiring and installation work? In some organizations no changes would be justified.



LIGHTING SYSTEMS are installed by workmen specially trained in the many types of lighting equipment.

But in many others, especially where work of all types is done, there may be definite advantages to organization of a special lighting installation department, equipped with new and efficient tools, and manned by mechanics specially trained to handle installation techniques inherent in today's modern lighting systems and technology.

Step 7 . . . Put Your Lighting Program To Work

The program to relight America is a practical job for practical men. It is a job that needs industry wide backing. But its ultimate success rests squarely with those who will design, sell, wire and install new lighting systems in the thousands of small establishments throughout the nation—stores, homes, offices, schools, factories, churches, theatres, institutions and others. The electrical contractors are the practical men who will do this job, operating at the local level, at the point of sale. These are the practical

men who must have the vision and the courage to tackle this job, to bring the fruits of modern lighting technology to the public.

Good lighting is contagious. Sell one good job in a store, for example, and every store employee becomes more lighting conscious. Also, customers visiting the store are impressed by one or more of the lighting techniques used. Subconsciously they want better lighting in their own homes, or in the places where they work or play.

Presented here is the framework for

a lighting program for electrical contractors. This program is flexible, it can be developed to suit the needs of every contractor, large or small. It is a program to promote lighting sales at the local level. If it is judiciously organized to custom-fit the contractor's individual organization and local lighting market potential, it will provide effective guidance for increased lighting sales. Its success will rest with the conscientious efforts at promotion and sales that go into putting this lighting program to work.

to stress benefits, and to aid the consumer in making an honest appraisal of lighting equipment, lighting systems and lighting results. This activity is needed to help the consumer understand this relighting market when the electrical contractors' lighting salesmen call.

Lighting promotion sponsored through the Lighting Program should embrace all fields and types of promotion—advertising, direct mail, radio and TV programs, talks before technical and professional groups, civic and community groups, etc. Suggested advertisements, mailing pieces, sales letters, etc. should be prepared and made available for all segments of the industry. Scripts on suitable topics should be prepared for radio, TV, and talks before professional, technical, civic and trade groups.

The Lighting Program should also embrace plans for training lighting industry personnel in promotion, including the planning of advertising and direct mail campaigns and giving talks before any of the groups.

This Lighting Program should further provide plans for lighting systems and lighting equipment displays in all major communities, which would be made available to all segments of the industry for showing to lighting prospects.

To develop and put into operation a Lighting Program such as is here proposed would be an expensive project. Considerable personnel, much of it highly specialized, would be required. Details for its financial support by all industry segments which would benefit by such a program would have to be worked out. But unless this, or some similar program, is made available to the lighting industry the individual branches of the industry will fail to do their most effective job in selling the existing relighting market of staggering potential to the detriment of the industry as a whole, and to the detriment of the business establishments that need to be relighted.

**Do These Things
To Sell Each
New Lighting
Prospect**

- 1. Arouse the Prospect's Interest in Lighting**
- 2. Get His Approval to Make a Lighting Recommendation**
- 3. Survey the Area To Be Lighted**
- 4. Make a Lighting and Wiring Layout**
- 5. Prepare a Lighting Recommendation and Quotation**
- 6. Submit Recommendation and Quotation to Prospect**
- 7. Close Sale and Have Prospect Sign Contract**
- 8. Install New Wiring and Lighting System**
- 9. Call on Customer After New System is Installed**
- 10. Take a Picture of the New Installation**

How To Sell Your Lighting Prospects

Each salesman has his own technique for selling. He should be encouraged to develop and use this technique, so long as it is sound and brings results. In selling modern lighting, however, experience has shown that the prospect is sold more quickly and more easily when the salesman follows a special routine, takes certain steps and does certain things for the prospect in their logical order. These steps are listed above and outlined in more detail below. The salesman should always use his own ingenuity in selling, and do those things which bring best results. But if he will develop his own special talents around the steps suggested here, he will in all probability sell more and better quality lighting systems. Use these reminders as a guide. Add any other steps which you find necessary or helpful in closing the order.

1. Arouse the Prospect's Interest in Lighting

- Through direct mail promotion
- Through advertising
- Through telephone calls
- Through personal calls

Developing a prospect's interest in relighting is a company responsibility as well as that of the salesman. The company develops this interest through its promotion activity. The salesman works more directly.

When you get an interview with a prospect, be prepared to talk lighting of the type he would require. Have photo-

graphs with you, showing modern lighting systems which would be applicable to the prospect's business. If possible, take him to see an outstanding new lighting installation, preferably one sold by you or your company.

If you don't get the prospect's interest on the first call, don't give up. Develop new sales slants and ask for another interview. Always assume he wants a new lighting system. Keep sending him promotion material, with specially written letters, and impress him that you have a personal interest in solving his lighting problem for him, to save him the time and trouble.

2. Get His Approval to Make A Lighting Recommendation

When the prospect begins to show interest, wants to know what type of lighting he needs, and how much it will cost, ask his permission to prepare a lighting recommendation specifically to cover his problem. Explain that this recommendation will be based on a plan tailored for him, and that no quotation can be made until the plan has been completed.

Discuss different types of lighting systems with the prospect, to get his reaction. Talk relative costs between systems, if necessary. His comments may give your lighting engineer some guidance.

Point out the importance of making a lighting plan. Explain that it will serve as a basis for more detailed discussion for both lighting and wiring layouts.



SURVEY of old job is made by salesman to obtain dimensional and other data needed to prepare new lighting layout.

3. Survey the Area To Be Lighted

- Get room dimensions and ceiling height
- Note finish of floor, walls and ceilings
- Measure the existing lighting intensities
- Check wiring system for capacity and details

Obtain a floor plan or electrical plan from the prospect, if he has one. Use it to supplement your own survey. Locate aisles, furniture, machines, etc. on plan when pertinent to the new layout. Record all information which may influence the design of the new installation.



LIGHTING RECOMMENDATION, quotation and formal contract are prepared by lighting specialist. Recommendation should be bound in attractive folder.

5. Prepare a Lighting Recommendation

Put your entire sales story, based on the lighting system recommended, in a report. Describe the lighting system proposed, list its benefits and advantages, and explain the proposed lighting system in detail. Stress any unusual features of the layout, including quality of equipment proposed. Attach the lighting plan, and bind in an attractive folder. Prepare formal quotation and contract agreement, and attach to recommendation.



WIRING LAYOUT for new lighting system is made by contractor's regular wiring design engineer.

4. Make a Lighting And Wiring Layout

- Prepare a floor plan of area to be lighted
- Locate lighting equipment on floor plan
- Show wiring circuits and switch locations
- Detail lighting equipment if needed for clarity
- Show elevation cross-section if applicable

On larger jobs where the wiring is complicated, a separate drawing should be made for the lighting and the wiring, to prevent confusion of the prospect. Make the drawings as neat, clear and simple as possible.



RECOMMENDATION and proposal are submitted to prospect by salesman, who explains all features and benefits of the proposed new lighting system.

6. Submit Recommendation And Quotation to Prospect

Present the lighting recommendation and proposed new lighting plan to the prospect. Go over the entire layout with the prospect. Explain every detail of work to be done, and describe as clearly as possible the lighting result which the new system will provide. Do not rush the prospect. Answer all his questions clearly and factually. Give him the quotation when he asks the price, but only after you have explained the layout fully.



FORMAL CONTRACT is signed by prospect after salesman has done thorough and complete selling job.

7. Close Sale and Have Prospect Sign Contract

Discuss the cost of the new lighting system with the prospect as long as he questions it, be sure he understands what is included in the contract, then have it signed. That clinches the sale.



TRAINED MECHANICS who know lighting equipment construction details install a new luminous ceiling lighting system.

8. Install New Wiring And Lighting System

When the prospect signs the contract, ask when your mechanics may proceed with the work. Be familiar with delivery on all lighting equipment and related materials. Schedule the work to proceed as promptly as possible, and make every effort to live up to your schedule. Cause as little interruption as possible to your customer's regular business.



GOOD WILL VISIT to new customer is made by the lighting specialist after installation is completed and job is explained in detail for customer's benefit.

9. Call on Customer After New System is Installed

A satisfied customer is an electrical contractor's greatest recommendation. A good way to clinch a lighting customer's good will is to visit the new installation with the customer after the job is completed. Take along a light meter. Show him the lighting result. Explain the installation in detail—point out all its advantages, discuss its benefits, explain the wiring installation and switching arrangements. Discuss all quality features of the job. This will create good will and be time well spent.



PICTURE of new lighting system is taken by salesman for use in contractor's jobs sold album and for future lighting promotion work.

10. Take a Picture of The New Installation

A photograph file of jobs sold is invaluable in selling new jobs. It adds to your company's prestige, and costs very little. So take a picture of each new lighting job sold, or have one made by a local photographer. Take the picture without flash or supplementary lighting, so that it shows the actual lighting result. Use a tripod and small lens aperture on the camera. The picture can also be used for future promotional literature, and for other publicity purposes.

Increase Sales With Modern Lighting Techniques

TODAY'S pace of lighting progress is quick. Higher standards of lighting quality and quantity are being accepted. New and improved light sources, luminaires and lighting devices are available. These are being combined as new lighting techniques and modern new lighting systems to provide predetermined lighting results. Consequently new concepts of lighting comfort and artistic lighting design are being realized.

This pace of lighting progress is the very essence of lighting market growth. Every new installation using new lighting techniques and devices immediately establishes new lighting standards in the community where sold and installed. The lighting in other establishments in this community is thereby obsoleted, and new prospects for relighting are created automatically.

Fortunately for the lighting salesman, the element of lighting design plays an important part in lighting application and sales. Through clever lighting design, the same new lighting devices and techniques can be used in many ways. This permits mass-produced luminaires and equipment to be applied in individual design treatments and combinations for every new job.

Shown here are just a few of currently available modern lighting techniques. These, and many others can be used most effectively today in the new and relighting markets to maintain a continuing lighting sales growth.



SHOW WINDOWS, centers of competition for public's attention, are a continuing market for new display lighting ideas.



OFFICE interiors offer prominent market for new lighting concepts to provide better quality illumination.



CLASSROOMS and schools, pride of local civic groups and citizenry, represent \$1-billion relighting market.



FACTORIES need quality lighting, better visual environments, to meet today's demand for increased production.



RETAIL STORES needing relighting total over two million, provide market for broad range of lighting techniques.



INSTITUTIONAL buildings afford market for standard and special interior lighting, also floodlighting applications.

Lighting Trends in 1952

1. Higher illumination levels are being accepted generally. Reduction of glare and use of improved visual environments are paving the way for use of intensities above 100 footcandles.
2. Better quality lighting for greater seeing comfort is being promoted, will receive approval of most critical user purchasers.
3. Improved spectral quality of lighting systems is receiving more attention for seeing problems involving color discrimination, especially in retail establishments.
4. Continuous row fluorescent luminaires constitute the mass market for most general lighting applications, will probably maintain this popularity for four or five more years.
5. Luminous ceiling lighting is on the increase in all types of commercial establishments, including some industrial applications. Better installation methods, lower costs, and improved quality are influencing factors.
6. Incandescent reflector lamps are being used for an ever-broadening field of application, especially in combination with fluorescent lighting in retail establishments, and for high bay industrial lighting.
7. Slimline fluorescent lamps are gaining in popularity, seem destined to gradually obsolete pre-heat standard type fluorescent lamps.
8. Modular lighting elements are finding wider application in buildings where architectural design and decorative treatments are important.
9. Improved reflector designs with upward component of light are being promoted for general lighting in industry, seem destined to revolutionize lighting in this field, open up huge relighting market.
10. Spectacular color lighting, with changing decorative effects, is being promoted—will probably increase in popularity now that successful dimming of fluorescent lamps is now possible.

Cable Layouts—Simple and Complex

By Ray Ashley

Research and Consulting Engineer
Chicago, Illinois

QUESTION: What two general classifications are given to layouts for cable installations? Define each.

ANSWER: Simple layout and Complex layout.

A Simple Layout is a first floor installation with normal working conditions and conduit runs free from obstacles, such as pull-boxes and fittings, at right angle turns.

A Complex Layout is one having adverse working conditions, such as terminal points at different floor levels, pull-boxes at right-angle turns, and cramped spaces for setting up and pulling cable.

DISCUSSION: It would be impossible to get cable installation labor units applicable to all conditions. Estimators have decided that two sets will serve as standards; one set representative of Simple and another representative of Complex Layouts.

Simple layouts require minimum time for moving in, setting up, and pulling cable. The signaling system, used for multiple-floor (complex) installations, is seldom needed. This layout covers limited conditions, whereas there is no limit to the types of installation that can be classed as complex.

Complex layouts require from 10 to

100 percent more time than simple jobs for the installation of the same cable. In a future article we will study the effects of pull-boxes at right angle turns—one type of complex layout. Multiple-story buildings present another.

On multi-story building projects, the cable may be pulled, either from the lower floor up or from the upper floor down. Since the latter is the more common practice it will be considered here.

In office buildings, hospitals, and other institutions, the switchboard is usually in the basement or sub basement. Moving in and setting up pulling

equipment requires more men and more time than a first floor installation. Cable must be moved to upper floors. This takes its toll in excess time. Braking and signal equipment also calls for extra man-hours.

We have studied only some of the major factors influencing cable installation costs. (See Electrical Estimating, Pgs. 56, 57, McGraw-Hill Book Co.). For each project the estimator must determine how much the work he is estimating varies from that to which standard units are applicable.

The next article will study Duplicate and Parallel cable pulls.

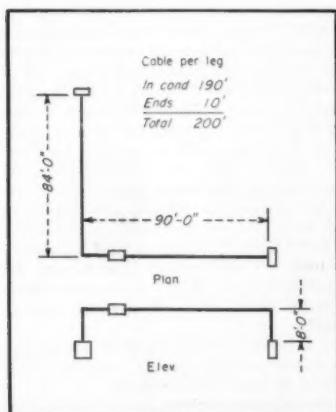


FIG. 1—SIMPLE LAYOUT has work all on one floor and one cable pull will be enough. Pull box (not at right-angle turn) is no obstacle.

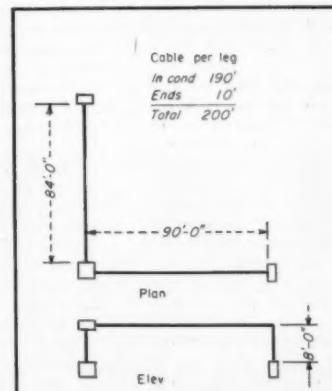


FIG. 2—COMPLEX LAYOUT has pull box at right-angle turn; requires two cable pulls. Installation labor units must account for the pull box obstacle.

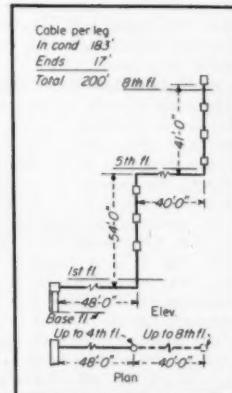


FIG. 3—VERY COMPLEX layout in multi-story building has cabinets on each floor, structural offsets and requires costly cable handling and pulling.

Engineering Analysis Leads To . . .

Engineering study led to selection of selenium rectifiers to meet dc power requirements in the Myrick Building. As a basis for the study, the original generating and distribution systems were surveyed, and data was taken on the conditions of the plant.

THE PROBLEM

The Myrick Building is an 8-story commercial and industrial building with a heavy direct- and alternating-current electrical load. Prior to the new rectifier installation, 3 steam- and 2 diesel-driven generators supplied dc power for part of the lighting load and for over 250 direct-current motors. Alternating-current energy for lighting and for ac motors was purchased from the utility.

An early decision was made to convert the entire lighting load to the utility's ac service. Design and construction of the necessary additions to the existing ac system had only to account for the increased load, and required little more than rewiring for a new 3000-ampere service breaker and 400-ampere distribution cubicles. This posed no unusual problems. But the matter of power supply for those tenants that required dc became a serious problem.

Several plans for providing dc power were considered:

1. Retain the existing generating plant.
2. Add 2 more diesel units; discontinue steam generation; and convert boiler to low pressure for heating only.
3. Install rectifying equipment for dc, and purchase all electrical power from the utility. Modify steam plant as in Plan 2.
4. Same as Plan 3, except that the utility might purchase all or part of the rectifying equipment.
5. Replace all dc equipment in the building with ac types, and complete conversion to ac. Modify steam plant.

COST STUDIES

Preliminary cost studies were made to determine the relative economics of steam generation, diesel generation and rectified purchased power.

The cost of all-steam generation was established from a power plant test report made by the building's former owners. After allocating the proper portion for the cost of heating, the steam generation cost was \$.0255 per kwh. This figure had to be evaluated on the basis of the economic conditions which prevailed at the time of the power plant test.

With steam and diesel generation, the total installed generating capacity of the plant was 750 kw, of which the diesels provided 200 kw or 27%. However, in the operation of the plant, the duty-cycle of the diesels was greater than that of the steam units. From data on the existing conditions, it was estimated that the diesels were supplying 45% of the kwh output of the plant.

An estimate was then made of the cost of diesel oil per kwh. Of the 800,000 kwh total yearly output of the plant, the 45% of diesel output was 360,000 kwh per year. The cost of diesel oil for the previous one year period was \$5,111. The cost of diesel oil per kwh was, therefore, \$.0141.

The total cost per kwh generated by the diesels was estimated by adding a labor and maintenance cost to the cost of the oil. For the entire plant, labor and maintenance amounted to approximately \$29,000 per year. However, the percentage of this chargeable to the diesels was not 45%, as was the output. Because diesels require no boiler maintenance nor an operating engineer, only 25%, \$7,250, was charged to the diesels. Amounting

to \$.0201 per kwh, the labor and maintenance cost was added to \$.0141 oil cost. Total cost per kwh generated by the diesels was \$.0342.

A cost study was also made for the possibility of rectifying purchased power. At the time of the study, dc requirements amounted to 50,000 kwh per month, 350 kw peak demand. Assuming a rectifying efficiency of 85%, the building would have to purchase about 59,000 kwh per month, 410 kw peak demand, to meet dc requirements. From utility rate schedules, it was found that the average cost of purchased energy would be \$.022 per kwh. With sale of dc power to tenants, at an estimated average rate of \$.036 per kwh, the use of rectifying equipment presented clear advantage.

Sale to tenants, 50,000 x .036	\$1,800.00
Cost of energy, 59,000 x .022	1,298.00
<hr/>	
Profit per month	\$502.00

CONCLUSIONS

Plan 1.—To maintain the existing dc power plant was costly and risky. In addition to the heavy costs for labor and maintenance, considerable investment would have been necessary for repairs. The coal-fired boiler was in such bad condition that its utility even for standby service was doubtful. There was a serious risk of boiler tube failure and shut-down of the plant. And heating as a by-product of generation would cost \$30,000 per year, after allowing for revenue from sale of dc.

Plan 2.—This plan required the addition of two more diesel units, disposal of the steam generators, and operation of the boiler at low pressure for heating only. Installed cost was estimated from \$10,000 to \$15,000. The total cost per kwh was set at \$.0272, allowing a profit of \$.420 per month from the sale of dc. Conversion of the boiler and piping system was estimated at \$5,000, the steam generators offering an indeterminate recovery as salvage. Heating would cost about \$20,000 per year.

Plan 3.—Rectifiers would cost from \$60,000 to \$70,000 installed. All of the existing dc generating equipment had resale value to offset this cost. The net cost of heating was estimated at about \$14,000 per year. It was recommended that selenium rectifiers be used because of their negligible maintenance requirements and high resale value. As dc tenants moved out, the dc load could be gradually eliminated, and the rectifier units could be sold one at a time. New tenants could be required to pay for ac lines to the service equipment. Rectifiers could be installed in a central bank in the engine room space, feeding into the existing dc distribution switchboard. No extensive rewiring would be necessary for dc; rentable area would not have to be used for rectifying equipment; and maintenance checking could be made at one central location.

Plan 4.—This plan was the same as Plan 3, with the exception that the utility would pay for the rectifying equipment. If submetering were not possible, heating would cost \$20,000.

Plan 5.—The overall cost of replacing all dc motors and equipment with ac equipment, with the necessary rewiring, made this plan completely unfavorable.

As a result of this complete analysis, Plan 3 was adopted as the most favorable alternative. Since the plan was originally developed, changes in tenants have considerably reduced the dc requirements and modified the specifications of the selenium rectifier installation.

...Modernizing With Power Selenums

Input to output—wiring and operation of a selenium rectifier power supply installed by the Standard Electric Company to meet heavy dc requirements in the commercial-industrial Myrick Building, Springfield, Mass.

By Richard C. Kleinberger, P.E., Consulting Engineer, White Plains, N. Y.

SELENIUM rectifiers proved-out as the most effective answer to heavy dc power requirements in the Myrick Building, Springfield, Mass. In this installation, a network of power and control circuits affords flexible, load-gaged output of the static rectifiers; and maintenance requirements are a minimum. From input to output, this new dc supply presents an on-the-job example of the installation and operation of selenium rectifier power supplies for industrial dc loads.

Installation

The complete rectifier supply is located in the old engine room space in the basement of the building. Five 40 kw rectifier assemblies, each in a cabinet 4 ft. by 4 ft. by 6 ft. high, are installed close together near the main dc distribution switchboard. Each unit has a drop-hinged door for easy access to the ac and dc terminals, thermal overloads, dc fuses and transformer compensating taps.

Power is supplied to each rectifier unit at 208-volts ac, 3-phase, 60-cycle, over 2000-ampere bus duct. Each unit is fed through a 400-ampere, 3-pole fused service switch to which power is tapped from the bus duct. The switches are wall-mounted behind the rectifiers.

Each rectifier unit has a 3-wire output—a common neutral conductor, one conductor 120 volts positive with respect to the neutral and one conductor 120 volts negative with respect to the neutral. Between the two outside conductors, 240 volts are available. A single 3-wire output from the five rectifiers is effected by connecting the corresponding "plus", neutral and "minus" conductors in parallel.

From each rectifier unit, the 3 output conductors are run in conduit to a wire trough above the rear of the units. In this trough, the output conductors from the five units are connected to three dc main feeders. The neutral feeder in the trough is car-

ried directly to the main dc distribution switchboard; each of the outside conductors is input to a separate current sensitive relay-circuitry. The two identical relay assemblies are panel mounted on the wall behind the rectifier cabinets. In each outside leg of the dc mains, the coils of four relays carry the load current of the leg and are set to actuate contacts which switch the individual rectifier units in or out of the circuit, depending upon fluctuations in the direct-current load requirement. The relay coils are in series in each outside leg which is carried from the output of each relay panel to the switchboard.

In all but rectifier unit No. 1, a 3-pole contactor has an operating coil circuit which is closed or opened by the contacts of one relay on each of the relay panels. From each of these rectifiers—units 2, 3, 4 and 5—two conductors tie the contactor starting circuit to the contacts of a relay on each panel. For this starting arrange-

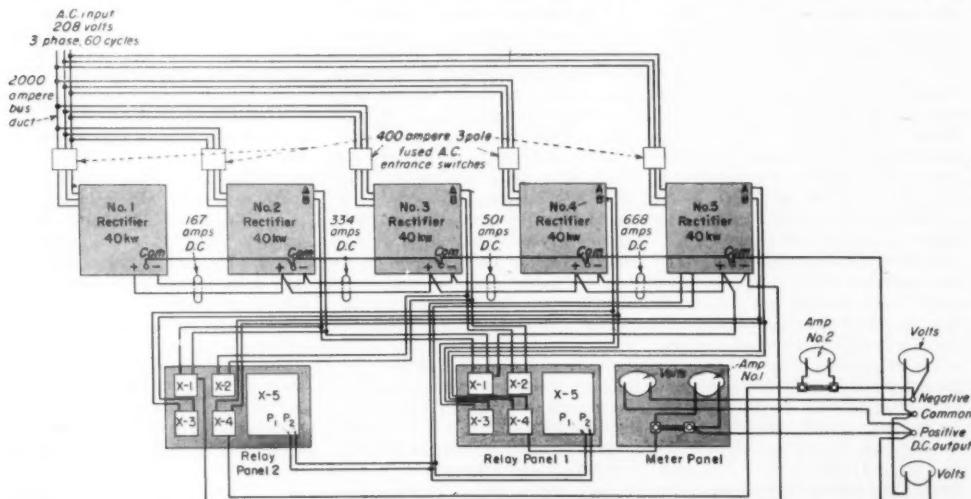
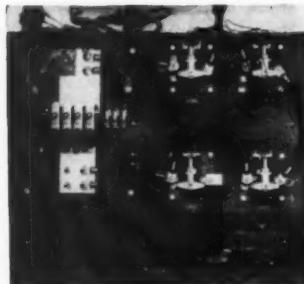


FIG. 1. Circuit diagram rectifier power supply shows interconnections between rectifier units and load control relay panels.



RELAY PANEL is one of two such units wall-mounted behind the rectifiers.



RECTIFIER UNITS, five-40 kw each, are located in a central bank.

ment, there are four SPST relays on each panel. In addition, each panel is equipped with a 4-pole relay which is energized and becomes a master relay when the load current closes the SPST relay in the starting circuit of rectifier 5. The coil of the master relay on each panel is connected in parallel with the contactor starting coil in rectifier 5. Details of the dc power circuitry and ac control circuits are shown in Figs. 1, 2 and 3.

Rectifier No. 1 is energized by closing a switch in the starting coil circuit of its 3-pole contactor, as shown in Fig. 3. In this unit, a jumper on terminal board TB-2 makes the contactor responsive to its starting circuit through the switch. In the other rectifiers, the contactor is responsive to the starting circuit which is closed by load current actuation of either of its two associated relays. For these units, the jumper is removed from TB-2, and the relay contacts are wired to terminals A and B.

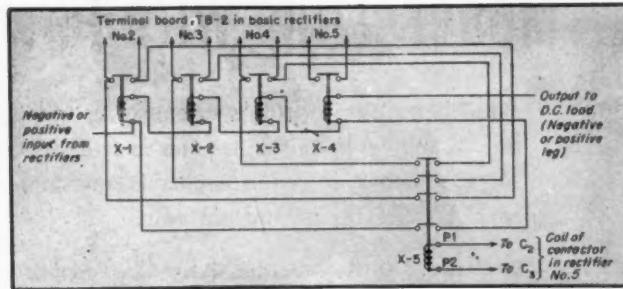


FIG. 2. Relay circuit of each relay panel, in each outside leg of the output, has 4 SPST relays actuated by load current and one master relay.

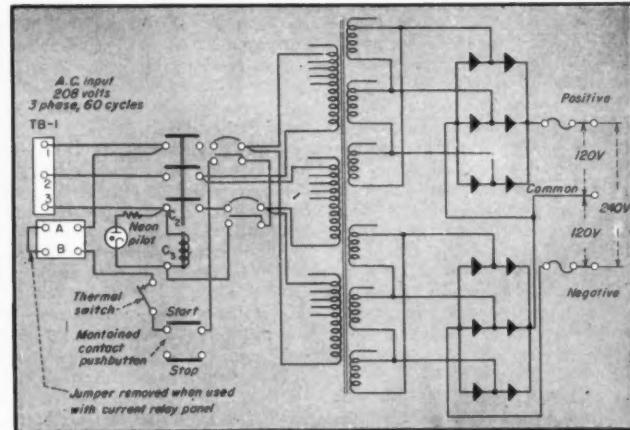


FIG. 3. Internal wiring of basic rectifier unit includes 3-pole contactor, starting circuit, delta connected transformers and rectifier bridges.

The operating sequence of this dc power supply begins by closing the switch in rectifier No. 1. Through the contactor, 3-phase ac power is fed to the transformer, stepped down in voltage and applied to a bridge circuit system of selenium rectifiers, Fig. 3. Two bridge circuits are used with their outputs in series. Full-wave rectification is obtained, with a fused positive conductor and fused negative conductor. A common conductor is tapped from between the two bridge circuits. This rectifying circuit is the same in the five rectifier units.

With rectifier 1 operative, the relay assemblies in the outside legs of the main dc feeders protect against over-load in either leg. Depending upon the current demanded by the load, the SPST relays will cut-in the necessary additional rectifier units to meet the demand. Each of the four relay coils in each outside leg is sensitive to a certain value of the load current which flows in it. When the load current

reaches the critical value for any one of the coils, the contacts of the relay close; and the ac starting circuit is energized in the associated rectifier unit. In turn, rectifiers 2, 3, 4 and 5 can be made operative.

When the value of the current in one of the outside legs is sufficient to energize all of the rectifier units, the master relay will take-over control. The coil of the 4-pole master relay is energized when rectifier 5 cuts in. Three of its four sets of contacts hold the contactor starting circuits closed in units 2, 3 and 4. The fourth set of contacts shorts the relay coil for units 2, 3 and 4. The load current then flows only through the relay coil for rectifier 5, which is necessary to maintain the SPST relay for unit 5 in the closed position.

Engineering design of the integrated system was done by the Richardson-Allen Corp., Long Island, N. Y., designers and manufacturers of rectifier power supplies.

Practical hints on the unpacking, checking, installation and maintenance of wet batteries used for emergency or special service.

By J. E. Vaughan

Field Engineering Supervisor
Gould-National Batteries, Inc.



BATTERY should be supported on sturdy racks designed so that units are accessible for the addition of water, checking of specific gravity and cleaning. Room should be cool and well ventilated to remove fumes from the vicinity.

MAINTENANCE OF FLOAT BATTERIES

LOAT batteries are standby units for use when: (1) normal power supply fails, (2) occasional peak loads are too great to be carried by the normal power supply, and (3) infrequently-operated equipment is powered exclusively by batteries. A float battery is connected in parallel with a motor-generator set or rectifier. These units supply sufficient dc to offset the normal self-discharge of the battery. They also recharge the battery when it has been called upon to do work and has been partially or wholly discharged.

The emergency-service nature of the float battery demands that it be fully charged at all times to insure its performance of duty when needed. Adherence to simple maintenance rules not only insures adequate battery power when required, but also lengthens the useful life of the battery.

Correct maintenance begins with installation. And, since the installation occurs but once in the life of the battery, it should carefully adhere to recommended procedures for placing a battery in service.

1. Unpack the battery cells carefully, handling them as you would any

glass commodity. Be sure all vent plugs are in place to prevent foreign material from falling into the cells. Slide cells from the packing case after removing packing material from top and sides. Do not lift cells by terminals.

2. Check the electrolyte level of each cell. If levels are below the level line, add distilled water. If there is evidence of electrolyte being spilled in transit, add sulphuric acid having the same specific gravity as the acid supplied with the battery. Bring the solution to the level line.

3. Install the battery in a ventilated room so fumes will be carried off. Do not locate in a warm area because heat accelerates self-discharge. Use sturdy battery racks designed so that batteries are easily accessible for the addition of water, taking specific gravity readings, etc. Insulate batteries from the rack to prevent possible grounds.

4. Clean all terminal contact surfaces. Brush posts with a wire brush. Clean lead-plated copper with sandpaper No. 00 grade or finer or a suede brush. Place thin film of non-corrosive grease on all surfaces that are to be bolted together.

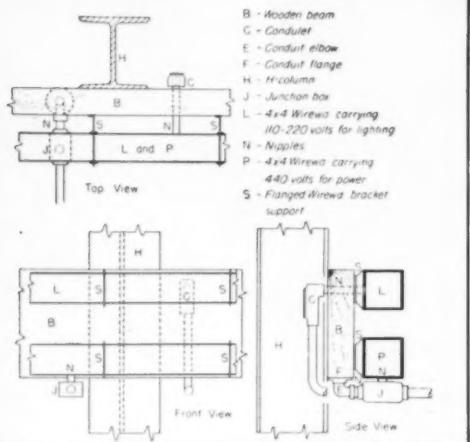
5. Connect the cells, positive to negative, and give the battery a freshening charge. Make battery-charger connections positive to positive and negative to negative. The freshening charge should be given at the finishing rate* indicated in the instructions furnished with the battery. Terminate the freshening charge 8 hours after there is no change in the specific gravity of a pilot cell, readings being taken hourly. Check and record the specific gravity of each cell to be sure all are in fully charged condition. Remove from the circuit any cell which does not come to full value, determine the cause of the low reading and repair the cell or consult the manufacturer. If the battery is to be operated with any cells missing, lower the charging voltage 2.15 volts per cell. Otherwise, the remaining cells will be overcharged.

The battery is now ready for use. In operation, the following maintenance procedures are recommended:

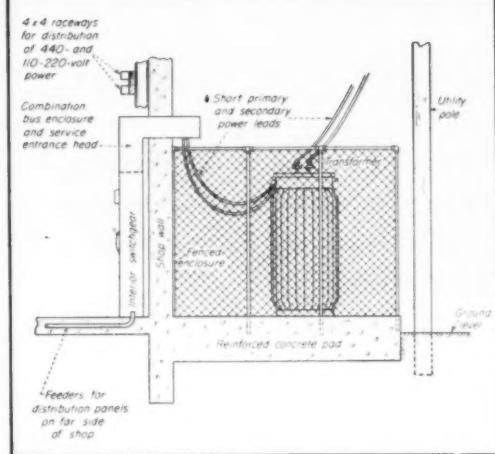
1. Maintain the battery at the

(Continued on page 225)

* To speed charging, batteries are sometimes charged at a high "starting rate" for about 80% of the charge and at a low "finishing rate" for the remainder of the charge.



PARALLEL RUNS OF SQUARE WIREWAY are mounted on beams bolted to structural columns. Branch conduits, also plank supported, are connected to feeder enclosures through junction boxes, condulets and nipples.



INDOOR SWITCHGEAR AND OUTDOOR SUBSTATION are both located adjacent to building wall, thereby shortening lengths of transformer leads and permitting extension of bus enclosure to serve as service entrance head.

SQUARE RACEWAYS— An Answer for Flexible Wiring

Faced with a rush order to install a comprehensive distribution system for an urgently-needed defense plant, Bruno Barth of the San Diego Electric Shop came up with some prompt, practical and economical solutions.

"PROVIDE immediately an electrical system with sufficient capacity and flexibility to serve an indeterminate number and arrangement of heavy duty machines." This was the substance of instructions received by Bruno Barth of the San Diego Electric Shop for a rush conversion of California General, Inc. of Chula Vista (a hardware manufacturing plant) to the manufacture of urgently needed stainless steel aircraft parts. Barth designed a system around the use of NEPCO 4-by-4 Wireways and met the job schedule.

First, as a support for the wiring channels, wooden 3-by-12 inch beams were erected horizontally along both side walls of the 60-by-220-foot machine shop, bolted to the building's structural H-columns at an elevation

of 10 feet above the working floor. Then two continuous runs of the 4-by-4 wireway were mounted on each beam.

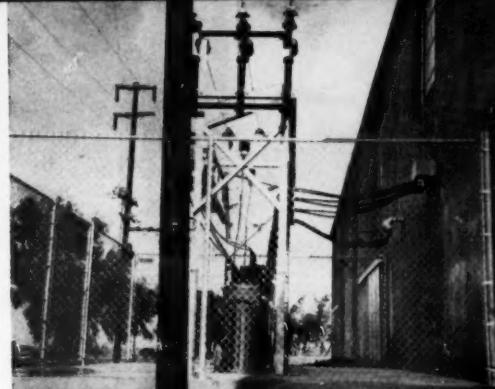
Since the future addition of a mezzanine level was under consideration and since the horizontal beams could serve as supports for the future floor joists, all electrical equipment was located *below* the upper limits of these backboards. Therefore, the upper surfaces of upper raceways (designed to carry 110-220-volt current for lighting and receptacle use) were set flush with beam tops, while the bottoms of lower raceways (scheduled to carry 440-volt power) were mounted level with beam bottoms. Wireway sections were secured by means of flanged brackets. With this arrangement of raceways, the elec-

trical system need not be disturbed in the event that the mezzanine is finished, yet feeders for power and light will be conveniently located to serve this anticipated upper floor.

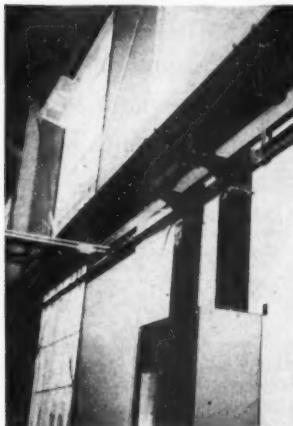
Connections between raceways and branch conduits were also kept below beam tops and, in order to minimize the physical strain placed on the metal enclosures, branch conduits were supported by the *beams* rather than by the raceways themselves. In the case of 440-volt power branches, this support was provided by elbows and conduit flanges secured to the bottoms of the planks, while wiring connections between these conduits and the lower raceways were made through junction boxes located directly beneath the gutters, then into strain-free nipples and knockout openings in the ducts. In the



MAIN DISTRIBUTION CENTER receives secondary power from outdoor transformers through wall-piercing bus enclosure (440 volts; left) and conduit (110-220 volts; right).



CONCRETE SUBSTATION PAD, poured as an integral extension of the building foundation, supports transformers in convenient proximity to service entrance heads and terminal pole of utility primary.



HEAVY WOODEN PLANKS, bolted to H-columns at height of 10 feet above floor, support horizontal wiring raceways, and provide for mezzanine addition.



LOCAL CONTROL PANELS are dead-front safety circuit-breaker assemblies. Wooden platforms in front of switchgear provide insurance against grounding.



BRANCH CONDUITS are connected to raceways either through junction boxes located beneath the lower wire enclosure or through rear-entrance conductors.

case of 110-220-volt branches, conduits were carried to outer walls of the building at the same elevation as power branches, then were bent upwards behind the beams, supported by Condulet fittings and upper-raceway-connecting nipples which were driven through holes drilled horizontally through the planks where required. Since beams are separated from side walls by a distance equal to the depth of the structural H-columns, ample room is available behind the planks for these rear connections.

In cases where branch circuits serve motors, receptacles or local lighting located in central areas of the shop, branch conduits are run horizontally at right angles out from the side raceways until directly over their intended points of application, then are dropped

to utilization elevations. These conduit runs are supported by means of purlin-fastened hangers. In cases where 110-220-volt circuits are carried upwards for general overhead lighting, conduits are connected to raceways in the manner just discussed, then secured to walls by clamps.

The adjacent location of outdoor transformers and indoor switchgear—separated only by the thickness of a wall—was another means for conserving hard-to-obtain materials. In fact, the bus enclosure atop the main 1200-amp 440-volt power breaker was extended through the wall and capped to serve as a service entrance head for six 500MCM cables, while the 110-220-volt feeders were similarly carried through an entrance head with a short length of conduit leading through

the wall directly to the low-voltage breaker cubicle.

Primary and secondary power leads are short since the utility pole line comes to within a dozen feet of the fenced substation pad which, in turn, was poured as an extension of the building's foundation.

The adoption of this distribution system gave flexibility with a minimum use of copper, inasmuch as only required wire sizes and lengths were installed. With the front sections of raceways hinged for ready access, additional circuits can be added as needed and, when a machine is moved from one section of the shop to another, the branch circuit, control and protective equipment can be readily shifted as a unit and reconnected to the most convenient power duct.



NEW MACHINES are inspected for electrical maintenance weak-points to determine a minimum stock of spare parts and to estimate down-time required for maintenance in case of total failure.

MAINTAINING a well-balanced inventory of electrical maintenance supplies no longer depends upon guesswork at the Kaiser Steel plant, Fontana, Calif. Here, the electrical maintenance department uses a standard procedure to relate stock supplies to the maintenance needs of all electric machine drives. This procedure includes inspection of each machine to determine its peculiar maintenance requirements and an analysis of when and how failure might occur and what failure will mean in terms of lost production units. For each electrical drive, this study solves that old maintenance problem—whether to stock spare parts or a standby unit.

Preliminary Study

The overall maintenance study for any machine begins as soon as the machine arrives at the plant. It is first inspected by an electrical maintenance supervisor who estimates which parts of the electrical unit will stand the most wear; which are most likely to fail early. A mechanical maintenance supervisor then makes a similar estimate for mechanical failures.

When the machine has been placed in service in some particular department, its job-importance is appraised by a supervisor from the Services Division, the high echelon of plant maintenance. He visits the department and determines from discussion with operating personnel the lost production units and wasted man-hours which would result from failure of the machine.

Correlating these three inspection reports, the maintenance department makes a preliminary study of the machine's maintenance needs. The direct results of this study are: 1) an estimate of time required to repair the motor, gearing and components; 2) an estimate of the percentage of repair which can be done at the plant; 3) a cost estimate of what down-time will mean in lost production to the department and to the entire plant.

Based on this preliminary study, the maintenance department will make an initial estimate of the minimum stock of spare parts necessary to maintain operation of the machine. This estimate is a suggested list of the number and types of spare parts, taking into consideration the operating conditions

and duty-cycle of the machine motor. Although this is the usual point at which the parts are ordered in many maintenance programs, the analysis is still far from finished.

Standby Units

The most important estimate of the maintenance analysis is that of "down-time"—the period required to remove, repair and reinstall the motor. This estimate is made for a maximum period of time, assuming the worst possible conditions of failure. Of course, the estimate of down-time can be modified by previous maintenance experience with a similar motor in a similar application. But great care must be exercised, inasmuch as the down-time is an important factor in determining the value of a standby unit as an alternative to the suggested stock of spare parts.

The electrical maintenance group then presents the down-time estimate to the superintendent of the department in which the machine is located. If the superintendent decides that the required down-time can be absorbed in his production schedule without a loss in production, it is fairly cer-

MOTOR LIST 86" MILL AND MOTOR ROOM

ITEM. NO.	APPLICATION	NO. REQ.	H.P.	R.P.M.	VOLTS	MFR.	DESCRIPTION	ITEM	STOCK NO.	SAME AS ITEM NO.	REMARKS
							TYPE	FRAME	MODEL	WINDG.	
3-1 789	25T Crane bridge	2	45		230	GE	MD	608AE	Ser.	M, A and B	5KK4216, 5KK4222
3-2 790-791	25T Crane main to aux hoist	2	65		230	GE	MD	610AE	Ser.	M, A and B	5KK4218, 5KK4220
3-3 792	25T Crane trolley	1	33		230	GE	MD	606AE	Ser.	M, A and B	5KK4227, 5KK4228
3-4 793	25T Crane bridge	2	45		230	GE	MD	608AE	Ser.	M, A and B	5KK4216, 5KK4222
3-5 794	Roll grinder wheel drive	1	40	850/1700	230	Rel	T	262-T	L-18366-TI	Shnt.	None
3-6 795	Roll grinder work drive	1	30	300/1800	230	Rel	T	385-T	U-8831-TI	Shnt.	None
3-7 796	Roll grinder carriage drive	1	5	450/1800	230	Rel	T	66-T	U-8832-TI	Shnt.	None
3-8 797	Roll grinder water pump	1	2	1150	230	Rel	T	CT-225-D	L-18367-TI	Shnt.	None
3-9 798	Roll grinder feed drive	1	2	1150	230	Rel	T	CT-225-D	L-18368-TI	Shnt.	None
3-10 799	Roll grinder carriage oil pump	1	1/2	1750	230	Rel	T	CT-203	L-18369-TI	Shnt.	None
3-11 901	Roll grinder wheel base oil pump	1	1/2	1750	230	Rel	T	CT-203	L-18370-TI	Shnt.	None
3-12 902	Roll grinder footstock drive	1	1 1/2	600	230	Rel	T	CT-225	L-18371-TI	Shnt.	None

NOTE. SPARES CODE - A=Armature - AC=Armature coils - B=Bearings - BT=Thrust bearing - BH=Brush holder - F=Main field coil - G=Generator - GT=Glass tubing - I=Inter pole coils - M=Motor - MG=Motor generator complete - R=Oil rings - RF=Rotor fields - RW=Rewind material - S=Stator - SC=Stator coils - T=Electronic tubes - C=Coupling - P=Pinion

INVENTORY CHART for one department lists motors, machines, spare parts, standby units and other essential information; facilitates keeping a well-balanced inventory of maintenance supplies.



MAINTENANCE ANALYSIS of the motor in each machine is based upon operating conditions, work-load and duty-cycle; reveals need for spare parts and the value of having a standby motor.



SPARE PARTS in the supply room are coded for easy selection from data contained on inventory charts; are well-balanced against standby units, as determined from maintenance analysis.

tain that the suggested stock of spare parts will be sufficient for maintenance of the machine. If, however, he objects to the down-time estimate as an impediment to his schedule, the electrical maintenance department must make a study of the machine's work load and duty-cycle.

In a hypothetical case, the objectionable down-time estimate might be 3 days. The electrical maintenance group must then determine how many hours per week the machine works and if there are any identical machines in the shop.

From the department superintendent, the duty-cycle of the machine is set at, say 15 8-hour shifts per week. In the plant, there are three 8-hour shifts per day, 7 days per week—a total of 21 8-hour shifts per week. In terms of 8-hour shifts, the 3 days of down-time would amount to 9 shifts. And from the superintendent's own estimate, the machine is idle 6 shifts per week. It is readily evident then that 6 idle shifts in one week and 3 idle shifts the following week will allow the required 9 shifts of downtime for maintenance.

In this case, it is clear that the 3

days needed for maintenance of the machine could be absorbed over a two-week period, with no loss in production. The first conclusion is, therefore, that spare parts will be purchased for the motor. But the advisability of having a standby unit also on hand has not yet been eliminated.

A check is made to determine how many motors in the plant are identical to the one in the machine under study. In some cases, there may be as many as 10 identical motors throughout the plant. The possibility of failure of this particular motor type is, accordingly, 10 times greater. Under such circumstances, the purchase of at least one standby unit would be reconsidered, particularly if each motor is working nearly full time. A standby unit will appreciably reduce the required stock of spare parts needed for maintaining the 10 motors.

Charting Inventory

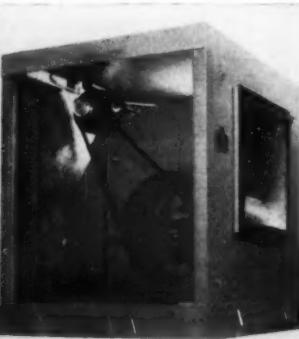
As a guide to effective use of this overall maintenance procedure, an inventory chart of motors, maintenance data and supplies is available for each of the various departments in the plant. Each of these charts lists the

necessary information for making a complete maintenance analysis of the supplies problem in each department.

A typical inventory chart is that for "Motor List—86 Mill and Motor Room". This chart (shown above) is broken down as follows

- Each motor in the department is listed by its "plant item number" and by the machine to which it belongs.
- The number of motors of the same type and rating for each machine.
- Electrical characteristics (hp, rpm and voltage) for each motor type listed.
- The manufacturer, type, frame number, model number and winding for each motor.
- Maintenance supplies in stock for each motor type, including spare parts and standby units. Major spare components are coded: A—armature; B—bearings; BH—brush holder; M—the complete standby unit.
- A column headed "Same As Item No.", listing item numbers for other motors in the plant which

(Continued on Page 224)



PROCESS OF ELIMINATION frequently determines the selection of a motor for a specific application, progressively discarding motors which cannot or need not be used. In a competitive market, it is essential to select a drive which will fulfill all requirements at the lowest possible cost. In

the case of a pushbutton-operated remote control for ac arc welders (left), a reversible capacitor-run motor arranged for plugging action for intermittent duty proved satisfactory. The belted blower (center) calls for a capacitor motor, while the washing machine (right) is powered as illustrated.

Application of Small Motors - Part 1

To drive the thousands of machines requiring only limited power, many types of fractional-horsepower motors are available, each best fitted for certain fields of application. Knowledge of their characteristics and purposes is essential for intelligent use.

By T. E. M. Carville

Manager, Industrial Small Motor Engineering,
Westinghouse Elec. Corp., Lima, Ohio.

HORSEPOWER per worker in industry has increased from 1/10th in 1899 to 6½ in 1946. But a like increase has also occurred in horsepower per housewife and per office worker. While motors employed in industry are principally in integral-horsepower sizes, those used in the home and office are generally fractional or sub-fractional. Literally millions of such motors are in use today, driving such machines as fans, oil burners, vacuum cleaners, typewriters, portable tools and office machines. Each application presents a problem in engineering, for economical considerations demand that the smallest and least expensive motor capable of fulfilling

the necessary requirements be used.

Factors to be considered in selecting a motor for a certain application include power supply, horsepower rating, torque requirements, limitations of locked-rotor current, overload protection, type of mounting and other mechanical features. These factors must be weighed carefully and, by matching machine requirements with motor characteristics, the best and most economical drive can be easily selected.

Power supply generally depends on the location of the machine, determined by its market. For small machines, the most common supply is 115-volts (or 115/230-volts) single phase, 60 cycle current. Market requirements

may dictate the use of universal (ac or dc) motors.

Horsepower rating depends on the torque required to drive the load, not only under normal operating conditions but also under momentary overloads. Duty cycle and frequency of starting (which may cause dangerous overheating) must be considered.

Check Nameplate Data

The motor must be capable of driving the machine without excessive temperature rise. Most open induction motors are rated for a 40° C rise on a 40° C ambient temperature. However, the nameplate may indicate a service factor, which is the percent rated load that can be carried continuously without exceeding a 50° rise. This service factor allows the maximum safe output to be obtained from the motor where operating conditions are fully known. Peak loads, even above the service-factor rating, can be carried for short periods if they are offset by loads below rated so that the average heating is under the 50° maximum. Service factor is dependent on the motor rating and is generally higher for motors of smaller ratings. In applying a motor to run at any overload, the duty cycle should be checked with the motor manufacturer.

However, the torque required by
(Continued on page 108)



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of Canada: Powerline Devices, Ltd., Toronto

**Application of
Small Motors**

. . . Starts on page 106

the appliance or machine at normal load is not the only torque to be considered. Both the locked-rotor and breakdown torques play important roles. *Locked rotor torque* is the turning effort produced at the instant of starting. Direct-connected fans, for example, require very little torque to start as compared with the torque at normal speed, but compressors, on the other hand, may require a starting torque above 200% full-load torque. Starting torque is often the determining factor in choosing a motor. *Breakdown torque* is the maximum torque an induction motor can carry without an abrupt drop in speed, which may make the machine inoperative.

Limitations of locked-rotor current depend on application and on power-company regulations. For example, to reduce the possibility of light flicker, many utilities restrict the use of single-phase motors with high locked-rotor currents. General rules are:

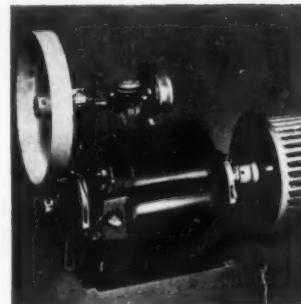
(1) automatically controlled single-phase motors for general use cannot draw locked-rotor currents greater than 20 amperes (plus 15% tolerance) at 115 volts, or more than 25 amperes (plus 15%) at 230 volts;

(2) manually controlled single-phase motors for general use cannot draw locked-rotor currents greater than 40 amperes (plus 15% tolerance) at 115 volts, or more than 50 amperes (plus 15%) at 230 volts;

(3) motors that draw locked-rotor currents greater than these values can be used if approval is given by the utility.

Rules (1) and (2) indicate recognition by power companies of their obligation to provide, without additional charge, sufficient line capacity to meet normal starting requirements. Rule (3) applies to the many instances where the starting currents of the motor are in excess of those permitted in rules (1) and (2). Here the utility determines acceptability of the installation based on the inherent line capacity at that specific location. Manually controlled motors are permitted to draw larger currents as they are started less frequently than automatically controlled motors.

Motors are often subjected to over-



FACTORS OF MOTOR SELECTION include available power supply, torque requirements, overload protection, limitations of locked-rotor current, horsepower rating, mounting details and other pertinent features. These factors contributed to the choice of a high locked-rotor torque split-phase motor for the dryer (top), a permanent-split capacitor motor to drive the direct-connected propeller fan (center), and, to operate a typewriter, the governor-controlled universal motor (bottom). Factors concerning motor mounting include type of coupling, position of shaft, characteristics of the base, necessity for vibration dampening.

load, abnormal heating, or severe starting conditions. In such cases, the use of built-in overload protection should be considered. It is particularly essential on automatic machines where severe overloads may be encountered.

Built-in overload protectors are of two types; automatic-reset and manual. (Continued on page 112)

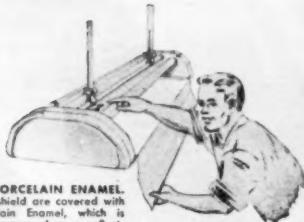
now, a new high in seeing comfort
through sensationallly-increased

UPWARD LIGHT...

Now, approximately $\frac{1}{4}$ of light is directed UPWARD through a completely new, precedent-shattering concept of lighting unit design! The new Benjamin "Task-Master" is the modern solution to the brightness ratio problem. By combining greater upward flow of light with a new high of 35° in lamp shielding, "Task-Master" doubles, even triples, present standards for industrial seeing comfort. In addition to sensationallly-increased UPWARD light and lamp shielding, "Task-Master" features revolutionary new, easier methods of installation and maintenance, such as those illustrated below. Send for FREE "Task-Master" Bulletin, giving further details. Write for Bulletin AD 5906. Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

BENJAMIN Task *Master*
Sold Exclusively through Electrical Distributors

DETACHABLE REFLECTORS
are hinged to make possible easier, more thorough cleaning right on the fixture. They may also be detached and cleaned away from the fixture. Available with sliding hangers, as shown.



"LIFE-TIME" PORCELAIN ENAMEL
Reflectors and shield are covered with genuine Porcelain Enamel, which is unsurpassed as a reflecting surface because it cannot wear, scratch or become dull.

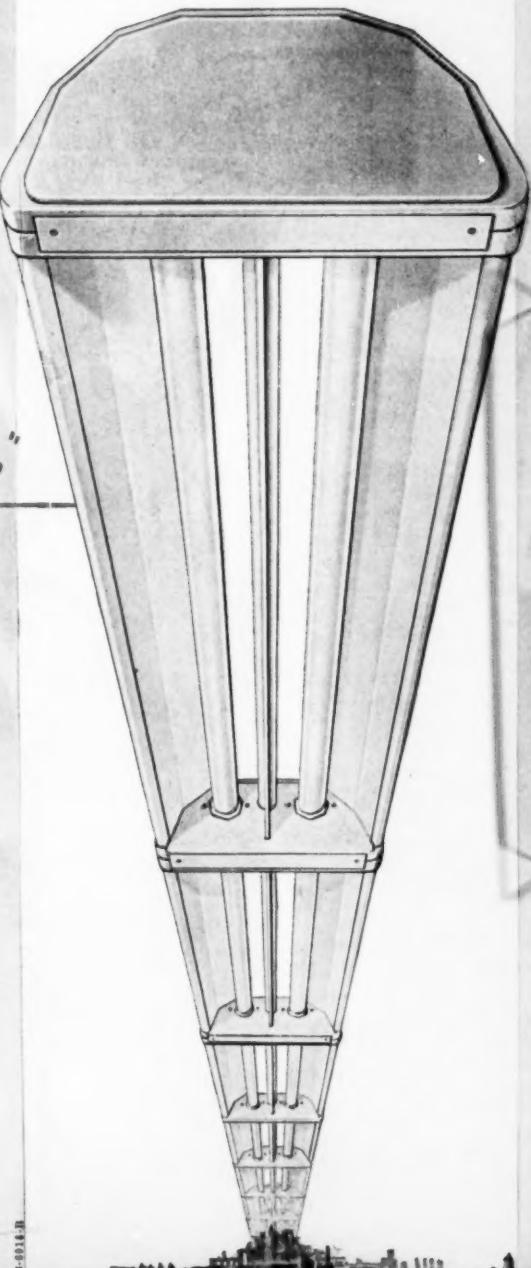
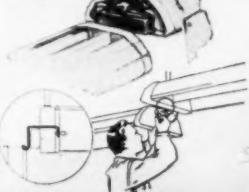
"SPRINGLOX" LAMPHOLDERS are standard equipment. These rugged, all-metal, lifetime lampholders facilitate lamping and relamping through patented spring design.

LONGITUDINAL SHIELD. Unique combination spine-support and lamp shield provides shielding angle of 35° . Result: great reduction of direct glare with consequent increase in seeing comfort.



PRE-WIRED—NO WIRE SPLICING. Delivered with all connections made up to terminal block. Branch-circuit wire comes already run through spine support, entire length of unit.

SPECIAL "HOOK-UP" DESIGN
makes it possible for the installer to temporarily hang one unit on another while connecting the jumper wires to opposite terminal blocks.



B-9018

"Stab-lok's tops

REGISTRATION APPLIED FOR



THERE'S NOTHING ELSE on earth like Federal Noark Stab-lok. Stab-lok is vastly more than a circuit breaker...it's today's most modern and flexible circuit protection system. Constant development has made it the most complete line on the market.

Single pole and double pole simultaneous trip Stab-lok breakers come in a standard 15 to 50 amp. range of calibrated ratings. The double pole breaker is exactly twice the width of the single pole, and both are readily interchangeable.

And now look at the full combination of six big advantages that you get *only* with the Stab-lok system!

For absolute dependability, perfect adaptability and lowest installation cost, join the stampede to Stab-lok — today.



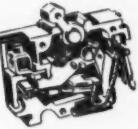
REVERSING CONTACTORS AND STARTERS
INDUSTRIAL SWITCHES - TYPE "D" SAFETY SWITCHES
E PANELBOARDS - FUSIBLE DISTRIBUTION PANELBOARDS
TYPE "D" SAFETY SWITCHES - DOUBLE THROW SAFETY SWITCHES
DISTRIBUTION PANELBOARDS - BUS DUCT - MANUAL MOTOR STARTERS
AND FUSE BOXES - CONTROL CENTERS - SWITCHBOARDS - LABORATORY SWITCHBOARDS
- PANELBOARDS - CIRCUIT BREAKER TYPE PANELBOARDS
- VOLTAGE MAGN

OK CIRCUIT BREAKERS • PANELBOARDS • COLUMN TYPE PANELBOARDS • PUSH BUTTON STATIONS • TYPE ABI INDUSTRIAL LS • SOLENOID TYPE RELAYS • AT WIRING TROUGHS • MULTIBREAKERS • NTPR PANELBOARDS • TROUGHS FOR SOCKET TYPE METER • COMBINATION MOTOR STARTERS • REVERSING CONTACTORS AND STARTERS • COTTERS • THREE THROW SAFETY SWITCHES • MAIN AND RANGE PULLOUT SWITCHES • MAIN SERVICE AND 1/4 DUCT • MANUAL MOTOR STARTERS • MAGNETIC CONTACTORS • CONTROL CENTERS • SWITCHBOARDS • CIRCUIT BREAKERS • PANELBOARDS • STARTERS • REDUCERS

on 6 big counts!"

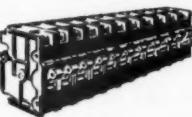
BIG, FULL-SIZE BREAKER

1 There's no skimping in size! Stab-lok is a big, husky, full-size breaker. It uses metal where it counts, *carrying current* . . . it has fewer and more rugged parts. This has been proved beyond question by independent laboratory tests.



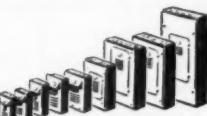
MILLIONS TESTED

2 Stab-lok is the *only* popular-priced breaker whose dependability has been demonstrated under every service condition. Millions of Stab-loks have been performance-proven. Stab-lok's the one popular breaker in which you can place complete confidence.



COMPLETE RANGE

3 Only Stab-lok system gives a complete range of enclosures. Besides nine basic devices, others are available for special applications. 3MBA, for one example, enables you to convert a multibreaker into a Stab-lok, easily and at low expense.



LOWEST INSTALLED COST

4 Stab-lok is the easiest, most economical breaker device to install. Stab-lok enclosures provide ample wiring space . . . the backplate is easily removed for wire pulling . . . all components are readily accessible . . . design features bring quick alignment in flush mounting.



4-WAY STABS

5 The stabs are an exclusive Federal Noark development and provide the safest, easiest method ever devised for inserting breakers. The 4-way stabs make instant, positive contact with specially designed main busses and are instantly *locked* into place.



COMBINATION FLUSH-SURFACE ENCLOSURES

6 Most enclosures for the Stab-lok Circuit Breaker System are of the famous Noark combination type for either flush or surface mounting. This practically cuts in half the stock of enclosures necessary to meet all requirements.



**Write for full information... and order
Stab-lok from your distributor**

FEDERAL ELECTRIC PRODUCTS COMPANY

59 Paris Street, Newark, S. N. J.

**FEDERAL
NOARK®**



"WE CAN DO A
JOB WITH DOW CORNING
SILICONE INSULATION THAT
OUR COMPETITORS CAN'T
MATCH WITH CONVENTIONAL
CLASS B INSULATION."

JOHN G. PERSON
ELECTRIC APPARATUS & REPAIR COMPANY
Philadelphia, Pa.

Application of Small Motors

... Starts on page 106

ual-reset. Both interrupt the circuit automatically when the temperature of the motor becomes excessive. The automatic type recloses the circuit automatically when the motor cools to a safe temperature. It is used on machines such as pumps and stokers, where a partial start of the motor before the source of overload is eliminated is not dangerous nor damaging to the equipment. The other is manually reset. It is used on machines such as oil burners, where a partial start may cause a flow of oil without ignition, which may interrupt coordination between controls and perhaps even cause an explosion when ignition finally does begin on a subsequent start. Before resetting the manual type, the cause of the overload should be determined and removed.

Many factors concerning *motor mounting* must be considered: the manner of coupling the shaft to the load, the position of the shaft, the method of attaching the motor housing to the machine, and whether a base or other mounting is to be used. If the motor is mounted vertically, the amount of thrust load on the bearings is important. If quietness is essential, a resilient mounting is necessary as all single-phase motors develop a pulsating torque that alternates at twice line frequency. However, a resilient rubber mounting can isolate much of the noise and vibration caused by this pulsation. Some mountings employ circular rubber rings affixed to the motor and shields that provide great flexibility to motion about the center of the shaft. Some applications require the use of a belt or flexible coupling to provide elasticity between the motor and machine shafts.

Fractional-horsepower motors are used on many machines, such as pumps, stokers, oil burners, and hot-water circulators, for which special mountings have been developed. One example is the refrigerator compressor, which uses a hermetic motor consisting of a stator and rotor without shaft, brackets, or bearings. This motor is installed in a hermetically sealed condensing unit and operates in the refrigerant. Such a motor may be either the split-phase or capacitor-start type, depending upon the rating and design of the refrigeration unit. As it

(Continued on page 114)

IN TODAY's ever-tightening pinch between rising costs and declining profits, your customers simply must have efficient production at low cost. They can't afford to ease the burden on their motors—they've got to have motors that will take it.

That's where you come in. You can custom-build those hard-working motors to stand up under an almost unbelievable amount of overloading and rugged service with Dow Corning Silicone (Class H) Insulation. You can use Class H to get as much as 50% more overload capacity, or to make motors last 10 to 100 times as long as they did with Class B insulation.

Yet Dow Corning Silicone Insulation is no more difficult for you to handle than Class B materials, and it carries a much better profit margin.

Maintenance, production, and top management men are quick to see the advantages offered by Class H insulation. When your work stands up where others failed, no more proof is necessary. The news spreads rapidly, and you gain prestige and new customers that increase your total volume of business. That's why we say:

**Dow Corning Silicones Build
Rewind Business!**

**Write
Today**

For more information, technical or sales assistance, call our nearest branch office or write to Dept. CG-22

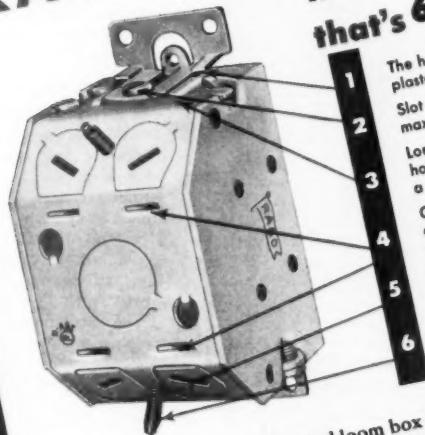
DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS
LOS ANGELES • NEW YORK • WASHINGTON, D. C.

**DOW CORNING
SILICONES**

RACO'S BLOS...

the one-screw box
that's 6 ways better!



The heavy embossed shoulder on the plaster ear insures greater strength. Slot and position of screw allow maximum adjustment - 0° to $\frac{3}{4}$ °. Long, deep embosses on body hold ear rigid and provide a perfect channel. Cable rests on these smooth embossments, securely held, well protected. Insert screwdriver in these angled slots and one natural twist removes KO. Clamp screws emerge from beveled side so box can be mounted on a flat surface.

This RACO one-screw, beveled loom box provides the answer to the electrician's need for a one-screw box that has a plaster ear with the strength to hold permanently, that can be guided evenly into place, and has up to $\frac{3}{4}$ ° of adjustment. What's more, the clamp screw emerges on the beveled side of the BLOS and allows it to be mounted on a flat surface. Here's another example of why RACO leads the field...from coast to coast.

You can always rely on RACO

RACO

ALL-STEEL EQUIPMENT Inc. — 800 Kensington Ave., Aurora, Illinois

"A BOX FOR EVERY NEED"



for timesaving...it's the GREENLEE Hydraulic Knockout Punch Driver

Perhaps you know this fine electricians' tool under its previous name—the "HYDRA-RAM".

Today, however, due to a conflict with the same name "HYDRA-RAM" for a product in another field, the name has been changed to GREENLEE *Hydraulic Knockout Punch Driver*.

But regardless of name — you'll still find it one of the finest timesavers available.

For the GREENLEE Hydraulic Knockout Punch Driver — coupled with GREENLEE Knockout Punches — makes easy, fast work of enlarging knockouts or cutting entirely new openings for conduit up to 4".

Operation is simple, fast — hydraulic pressure does all the work for you. Developing over *eleven tons* of ram force, it drives the GREENLEE Knockout Punch through 10-gauge metal with ease. Makes cutting holes in tight places easier, too, for no wrench space is needed.

Speed conduit installation jobs, save labor with this powerful, handy tool. Set comes to you packed in a sturdy metal carrying case. Get complete details — write Greenlee Tool Co., 1750 Columbia Avenue, Rockford, Ill.



OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hydraulic Conduit Benders • Hand Benders • Cable Pullers • Auger Bits • And Many Others

Application of Small Motors

... Starts on page 106

is impractical to use the common centrifugal starting switch, a starting relay is employed. Relays for split-phase motors operate on the current in the main winding, which at the locked-rotor condition connects the auxiliary circuit. As the speed of the motor approaches the point where the main winding develops breakdown torque, this current decreases. When it is insufficient to hold the relay closed, the auxiliary winding circuit is opened.

Analysis of a Typical Application

It is helpful to understand why a certain type of equipment is usually driven by one type of motor and, for this purpose, a general guide for selecting motors to drive newly designed machines is contained in Part II of this discussion. Frequently selection is done by a process of elimination until the choice of drive is narrowed down to one or two.

The small domestic oil burner, for example, is analysed as follows:

Power supply—single-phase ac.

Horsepower—between $\frac{1}{8}$ th and $\frac{1}{6}$ th hp at 1725 rpm.

Torque—mostly blower load plus small pump load. Starting torque is therefore low.

Locked-rotor current—NEMA or utility regulations govern.

Overload protection—must be manually reset, as required by Underwriters' Laboratories.

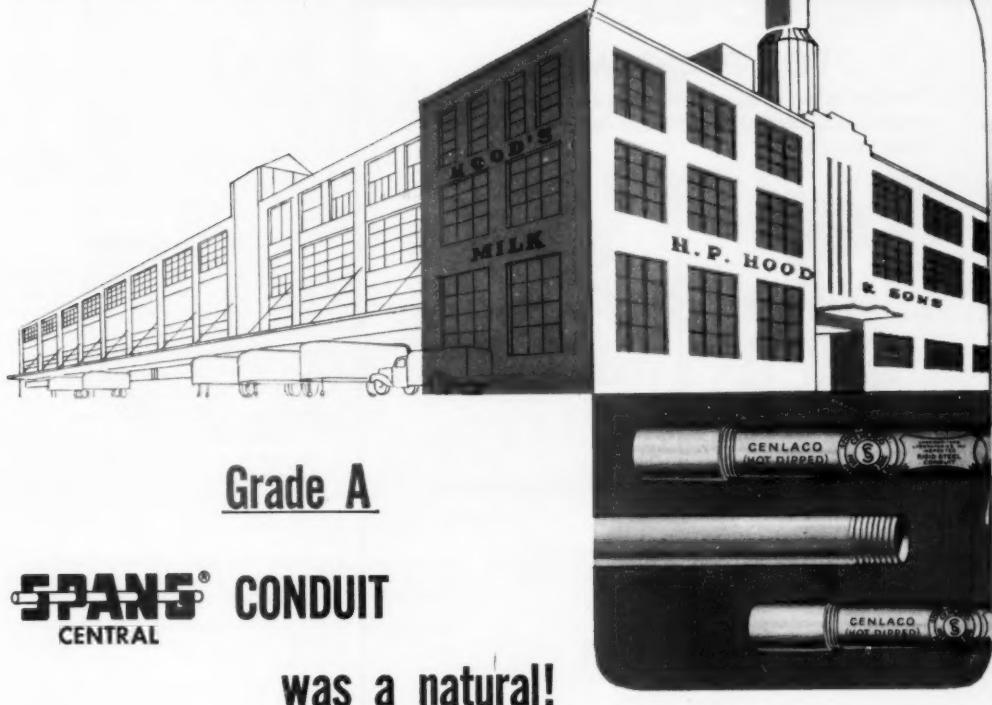
Mechanical features—industry standard is totally enclosed, flange-mounted motor.

Single-phase 60-cycle power is available in most locations where oil burners are used. This eliminates dc motors for most burners, although a few are used. As the equipment is stationary and requires a relatively low speed, universal motors offer no advantages. Polyphase current is seldom available in small houses and such a motor is further undesirable as its cost and that of its control are higher.

The horsepower required eliminates such types as the shaded-pole and hysteresis motors. As speed is constant and starting torque low, capacitor-start motors have no advantage for this small rating. This leaves the split-phase, normal-purpose, low locked-rotor-current motor as the

(Continued on Page 116)

in this modern dairy plant



In H. P. Hood & Sons dairy plant the emphasis is necessarily on rigid standards of cleanliness and efficient, dependable operation.

It was only natural that in designing their Boston plant for the production of Grade A dairy products, H. P. Hood & Sons selected only Grade A materials. Which makes significant their choice of Spang Central Conduit . . . for control systems and many other needs in their original plant, as well as in the numerous additions which have been made during the past several years.

Spang Conduit is well suited for rigorous conditions. At H. P. Hood, for instance, they find the outside wall never chips or flakes even when forming difficult bends . . . remains watertight and always dependable through continual scrubbing and other sanitary techniques. All of which results in complete, life-time protection for all their electrical circuits.

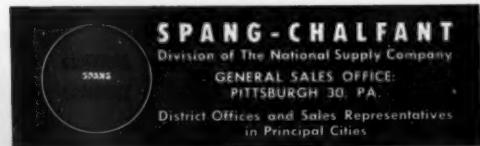
This is but one more example of the reliance that prominent

architects, contractors and owners place in the quality-controlled conduits by Spang—"Cenlaco", "Central White", "Central Black", and "Central EMT". Wherever reliability is a must, faster installation important, you'll find Spang Central Conduit with its easier bending, threading and cutting characteristics is the best that money can buy.

OWNER: H. P. Hood & Sons Company, Boston, Mass.

ELECTRICAL CONTRACTOR: M. B. Foster Electric Company, Boston, Mass.

GENERAL CONTRACTOR: William M. Bailey Company, Boston, Mass.



FULLMAN

Latrobe

PRODUCTS

FLOOR BOXES

WIRING SPECIALTIES



TOP PERFORMERS

"Latrobe" Floor Boxes and Wiring Specialties are top performers because they are expertly designed of the finest materials.



No. 284 Nozzle with
No. 200 Cover Plate



No. 330 Tom Thumb
Utility Outlet

This Duplex Receptacle Nozzle is the most useful and efficient on the market. It is furnished with $\frac{1}{2}$ " or $\frac{3}{4}$ " brass pipe extension, and easily installed.

A handy general purpose outlet for use in windows, doors, etc. Quickly installed without special tools and without marring wood-work finish.



The Improved "Latrobe" Adjustable Floor Box

Now equipped with an insulated 14-strand copper wire which provides a positive electrical bond between exposed flush parts and conduit system, conforming to Underwriters' Laboratories specifications. One terminal comes attached to bottom of box, and the other may be readily attached to cover. Once installed, wire cannot come in contact with exposed receptacle terminal screws inside box. Completely fireproof. Complies with National Electrical Code.

Sold Only Through Wholesalers

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

Application of Small Motors

. . . Starts on page 106

logical choice for driving the small oil burner.

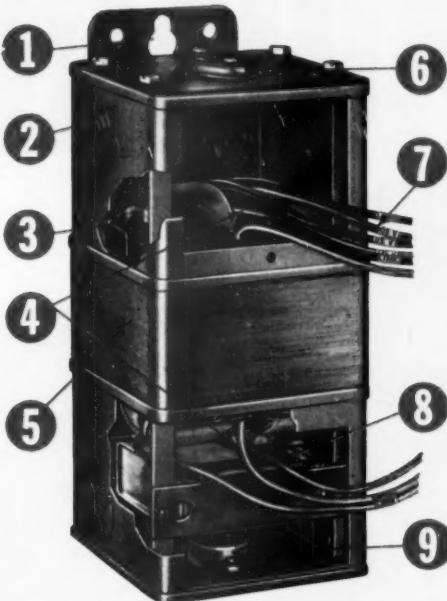
Larger oil burners for commercial purposes employ motors rated $\frac{1}{4}$ -hp and larger. The motors for such burners can be chosen by a similar analysis. Almost invariably recently built burners employ low-torque, split-phase motors in ratings up to $\frac{1}{2}$ -hp and capacitor-start motors, principally because of their low locked-rotor current, in larger ratings. Still larger industrial oil burners require integral-horsepower motors and generally use polyphase equipment.

High Starting Torques

The type of motor best suited for other applications is selected in the same fashion. For example, the choice for a pump or compressor narrows down to either the capacitor-start or repulsion motor, the only two that can supply the high starting torque required for the larger ratings. The capacitor motor is usually chosen. The motor selected for fans depends on several factors: type of current (or universal), type of operation (constant or adjustable-varying speed) and horsepower rating.

After the type of motor and its rating have been tentatively selected, it is advisable to make an application test of the motor or the apparatus, particularly if large-scale production is anticipated. If possible, the test should be made with a motor on which data is available, so that the wattmeter readings can be used to determine the actual horsepower required for different loads on the machine. Tests should be taken at reduced line voltage to ensure that the motor has sufficient starting torque and breakdown torque to operate during starting and at peak loads under the lowest voltage conditions likely to be encountered. From this test data the suitability of the motor can be determined with finality. In many cases, and especially where large-quantity production is contemplated, the machinery engineers and application engineers of the motor manufacturer work together to select the motor that will meet all the requirements at the lowest cost. A wise choice can do much to improve the position of the equipment manufacturer in a competitive market.

BETTER- Nine Ways



FOR INDOOR MERCURY LAMP OPERATION

Only
JEFFERSON
TRANSFORMERS
have ALL these
EXTRA-VALUE FEATURES

1 EASY MOUNTING!

Top and bottom brackets have key-hole slots for easy positioning and two holes for locking bolts. Brackets are removable or reversible for messenger wire suspension, etc.

2 PLENTY OF KNOCKOUTS!

One-half and $\frac{3}{8}$ " knockouts in sides of wiring compartments at each end. Two $\frac{1}{2}$ " knockouts in each end plate.

**3 DOUBLE VARNISHED
CORE AND COIL!**

oven baked polymerizing varnish impregnation assures permanent insulation and protection against moisture.

**4 INCANDESCENT & MERCURY
LAMP LEADS, BOTH ENDS!**

For fast and convenient wiring of combination mercury vapor and incandescent lamp fixtures. Mercury lamps can also be wired from either end of transformer.

5 PRESS FIT RIVETED CORE!

For positive uniformity of manufacture and maximum quality.

You find *all* the extra-values *only* in the newly revised line of Jefferson Transformers. Every feature vital to top-flight service, economy, and ideal lamp performance is built-in to give you unmatched value in every detail.

Write for 16-page illustrated Bulletin 521-5 now.

The Jefferson line also includes the finest transformers for both H-12 and H-15 1000 watt mercury lamps.

**6 INTERCHANGEABLE
FITTINGS!**

Pryouts on both ends expose standard $\frac{1}{2}$ " conduit fittings for suspension type mounting of transformer and/or lamp. $\frac{3}{4}$ " fittings quickly interchangeable.

7 THREE PRIMARY TAPS!

Color-coded tagged leads for positive identification and quick wiring. Three primary taps (not just two) for close matching with line voltage, and maximum lamp and transformer performance.

**8 AMPLE WIRING
COMPARTMENTS!**

Condenser located to allow ample wiring space when any knockout is used. Condenser is solidly mounted to prevent damage by vibration to condenser and leads.

9 NO OBSTRUCTIONS!

Plenty of room between condenser and conduit fittings to run wiring through lamp suspension conduit. Save time, trouble, and outside wiring. End cover knockouts are completely free of obstructions for quicker installations.

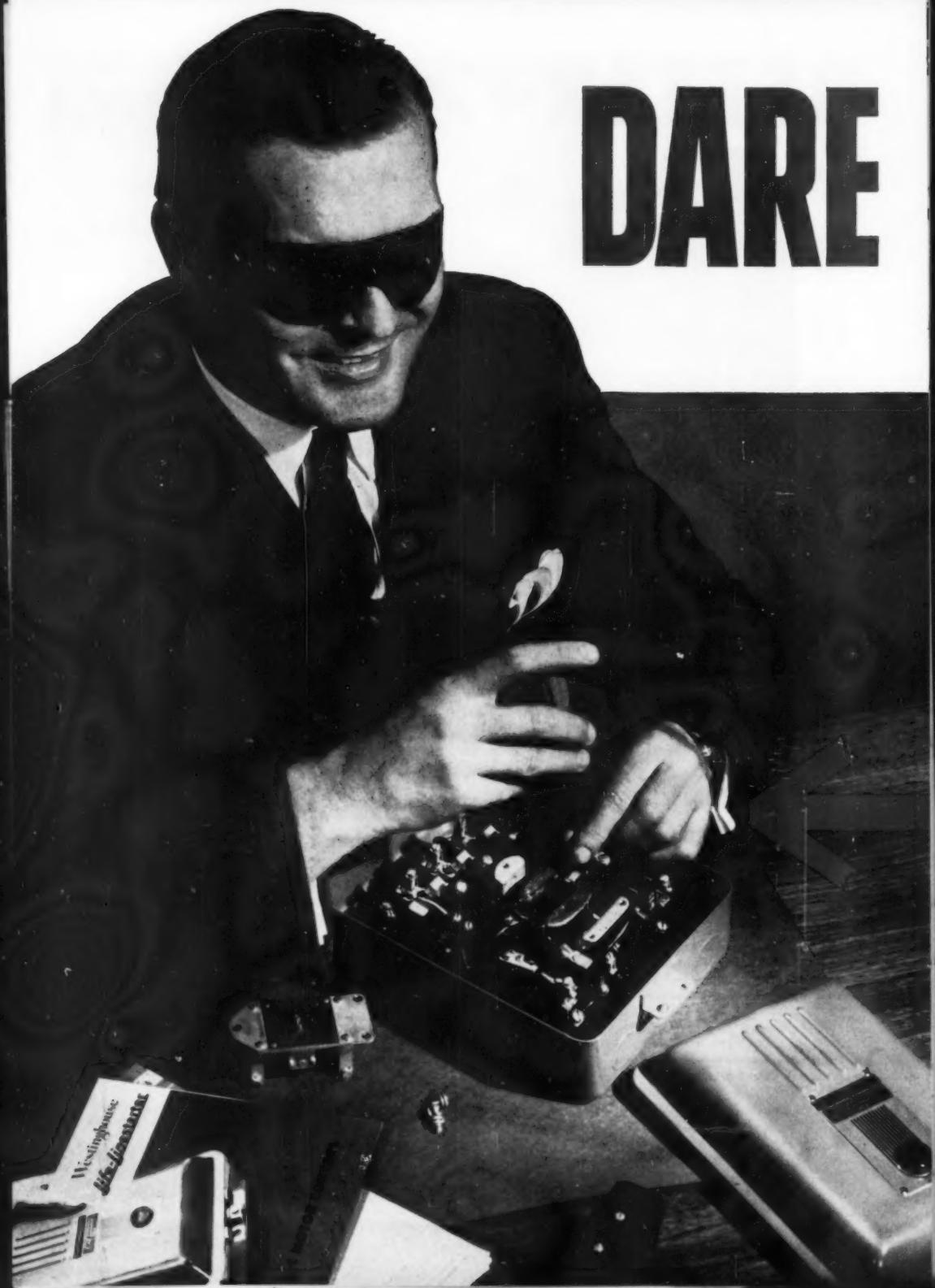
Get the most out of your mercury lamp installations by insisting on Jefferson Transformers. They operate all H-1 400 watt mercury lamps. Models are available for all indoor and outdoor applications. Underwriters' Laboratories approved.

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

Jefferson *Transformers*



DARE



TO COMPARE !

The Simplest...

Compare the fewer moving parts—the easy installation—straight-through wiring that simplify the Life-Line design . . . See the uniformity of line and interchangeability of parts . . . Watch how quickly parts are front-removable. So simple. You can do it blindfolded! Which means—simplified maintenance!

The Toughest...

Compare the rugged construction of the enclosure which is Bonderized* and finished with baked grey enamel. Rust resistance that lasts a lifetime . . . See the positive protection that Life-Line offers with the patented "De-ion" Arc Quencher that stops contact pitting and provides greater arc interrupting capacity . . . Watch how the bimetallic relay gives snap-action overload protection.

The Most Dependable Linestarter Ever Built!

Read what this chief electrician of a large southern paper mill* says: "The Life-Linestarter, through a foot-operated pushbutton, starts and stops the motor four times a minute, 24 hours a day, 30 days a month. After at least a million cycles, contacts showed little wear."

SEE FOR YOURSELF!

Ask to see the "Strip-Down" Test. It will open your eyes to Life-Linestarter's stepped-up performance and maintenance. Your Westinghouse salesman will show you. Or send for, "Tomorrow's Starter Today", B-4677. Write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pa.

*Name on request

J-30096





with CLARK Type "CY" COMBINATION AC MOTOR STARTERS

Clark type "CY" Combination Starters offer many cost-saving advantages.

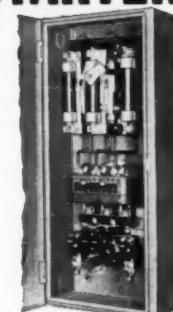
They cut installation costs—only one cabinet to mount.

They cut wiring costs—simply connect to power line and run leads to equipment to be controlled.

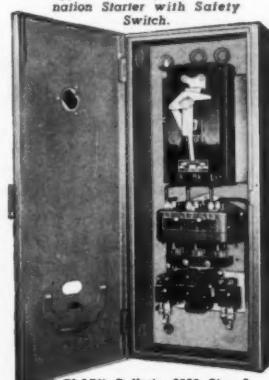
They simplify inspection and reduce maintenance to a minimum. Moving contacts are inspected by merely pushing down the contact bars—stationary contacts by opening snap-action cover clips and releasing lower arc shield. Because the arcs are magnetically rotated pitting and corrosion of the twin-break silver-alloy contacts are negligible. However, if contacts must be replaced, this can be quickly done with a screw driver and a wrench, without removing starter from cabinet. These, like all other parts, are front removable. And the entire control unit—on baseplate—can be lifted from the cabinet after disconnecting leads and loosening 3 screws.

Type "CY" Combination Starters are designed in many styles, sizes and enclosures. Shown here are Bulletin 6018 combining a fusible or non-fusible safety switch and a size 2 type "CY" starter—and Bulletin 6020 combining a size 2 type "CY" starter and a circuit breaker—all in a single, neat enclosure.

Available Through CLARK Distributors.



CLARK Bulletin 6018 Size 2
Type "CY" Magnetic Combination Starter with Safety Switch.



CLARK Bulletin 6020 Size 2
Type "CY" Magnetic Combination Motor Starter with Circuit Breaker.



THE CLARK CONTROLLER co.

ELECTRICAL CONTROL • 1146 EAST 152ND STREET, CLEVELAND 10, OHIO

Practical Methods



NEW SERVICE BODIES with bins and shelves accessible from outside have replaced the five-truck fleet of panel bodies formerly used by Elder Electric in Miami, Florida. With shelved panel bodies, according to James W. Elder, Jr., mechanics piled material on the floor which meant waste time looking for items in the pile and inconvenient access to the shelves. The new bodies (McCabe Powers SM10 installed on a Dodge chassis) are a complete shop. Material and equipment carried include all sizes of fuses, quantities of wire up to No. 1, boxes and wiring devices, conduit and EMT up to 1½ inches, ladders, meters and pipe tools and the miscellaneous supplies needed for installation and service work.

Safeguarding Milling Machines

PRODUCTION

A protective application of permanent ammeters has been introduced in machine shops and industrial plants in Southern California. C. T. Smallcomb, president of Smallcomb's Electric Co., Los Angeles, has made many such ammeter installations to protect overworked milling machines, lathes and automatic screw machines.

The problem which this method eliminated had become a serious one in these machine shops. Due to the urgency and volume of defense production, milling machines would often develop electrical overloads. When the overload relay cut out the machine, and the machine stopped, valuable and expensive carbide tools were ruined, the tools breaking off in the work. Because carbide tools cost anywhere from \$80 to \$100, and because the waste of these tools became excessive, a way was sought to detect overload before it kicked out the relay and stopped the machine.

Smallcomb's solution to the problem was the installation of permanent ammeters, mounted on each machine in full view of the operator. The am-

meter indicates the current drawn by the machine's motor in relation to the overload current which will kick out the motor. Although the installation cost only \$45, the protection it affords has already resulted in many shops in savings of as much as 800% of the cost of carbide tools. From the visual load current indication, the machinist can quickly and easily tell when a machine should not be further loaded.

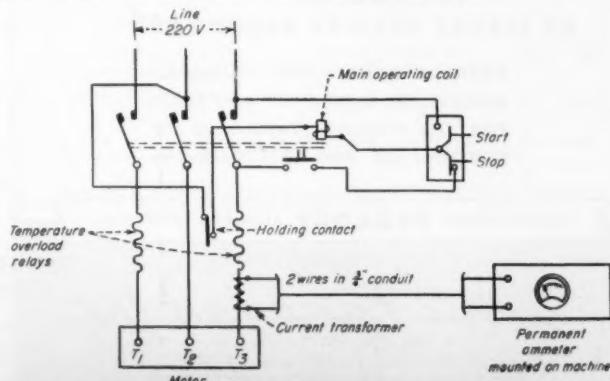
The hook-up of these permanent ammeters is relatively simple. In addition to the meter, a current transformer, hook-up wire and conduit are needed. The meter is mounted in front of the machine, where the machinist can watch it during the complete milling operation. From the meter, the wire in conduit is carried to the current transformer which is around one of the 220 vac motor leads.

The meters used in these shops were of the direct reading type, either 0 to 100 or 0 to 150 amps. Of course, the meter ratings depended upon the starting loads of the machines, usually three times the normal running amps. The meter scale must, therefore, be to 150% of the machines rated current.

In these installations, the rated



PERMANENT AMMETER, mounted above milling machine, indicates the load on the motor; has operating current and overload current marked on enclosure (arrow). Machinist keeps machine below overload to prevent breakage of valuable and costly carbide tools.



CURRENT TRANSFORMER ties permanent ammeter into one of the 220 vac motor leads. Wires in conduit connect meter at machines to CT at starter.

FARADAY FIRE ALARMS

WHETHER the "fire" problem is minor or major, your primary concern is to make sure the system is "fool-proof". Faraday stations, control panels, complete systems are known throughout the industry for their dependability. Protect with the best—Faraday.



FARADAY BELLS

The "electrical nerve network" that keeps big or little plants going must be better than average. Years of experience, design, know-how have made Faraday visual and audible signaling devices the outstanding brand. Illustrated Model ATL-700 Vibrating Bell is one of the many in-plant units planned for better department coordination. Buy Faraday—they're dependable.



FARADAY

**THE EMBLEM
OF SIGNAL SERVICE SINCE 1875**

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SYSTEMS ARE ENGINEERED AND BUILT
FOR THE HIGHEST STANDARDS IN
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operating current value for each machine was marked in black on the meter enclosure. On a milling machine rated 20 amps, for instance, "20" was marked on the enclosure. The overload current rating, 25% above the operating rating, was also noted. From these markings, the machinist knows the work capacity of his machine, and will operate it within the safety limits.

Protecting Electric Welding Machines

MAINTENANCE

A tried and proved application of a magnetic starter can effectively eliminate a serious hazard on electric welding machines. This practical maintenance method, as described by Albert A. Denio of Lowell, Mass., safeguards the type S feed cable on single-phase ac transformer type welders and 3-phase ac motor-generator type welders.

Prior to the development of this safety measure, a serious problem existed. Frequently, when an operator

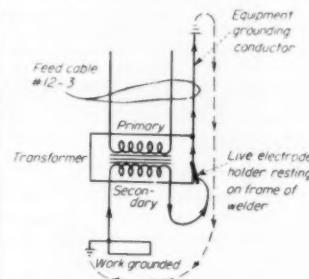


FIG. 1—Short circuit of the transformer secondary exists from the live electrode holder resting on the frame, through the equipment ground wire in the feed cable and back to the transformer through the grounded work.

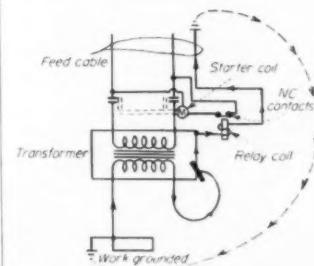
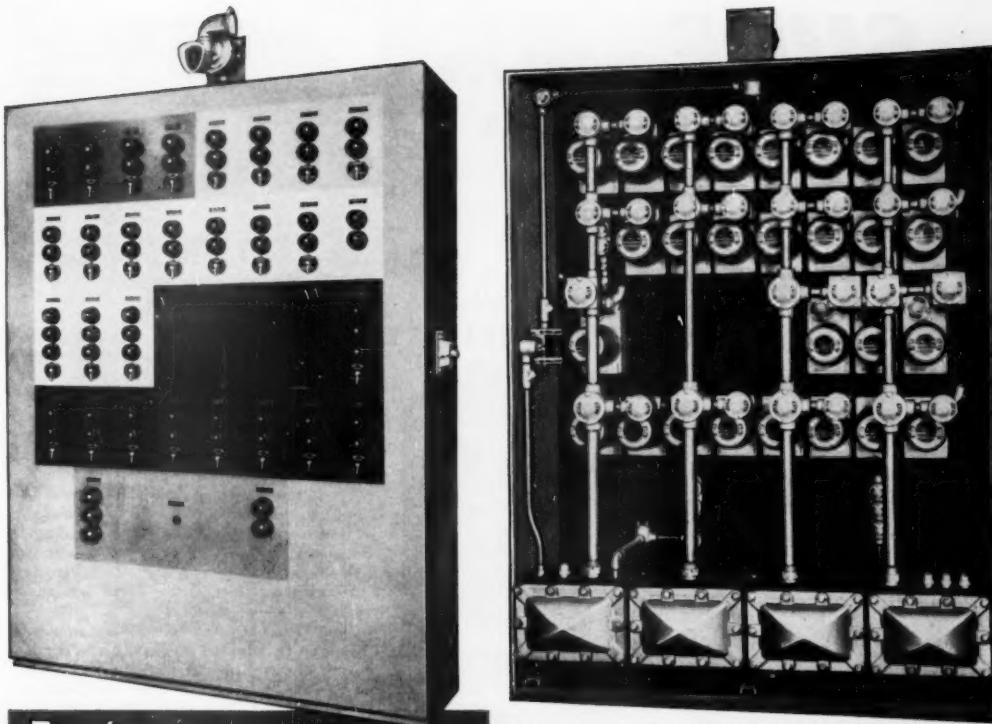


FIG. 2—Protective hook-up of magnetic starter and relay coil opens the transformer primary on high current flow in the No. 12 ground wire.



Front and rear views of alarm panel containing 27 Type EKP explosion-proof Visularms built for a chemical plant.

Visalarm CONDULETS*

- 1 **Pilot lights** give visual indications of normal and abnormal temperature, pressure, liquid level, speed, load or other conditions.
- 2 **Bell or howler** can be used to give an audible signal. A single bell or howler can serve any number of Visalarms.
- 3 **Flashing light** instantly directs attention to the proper control station.
- 4 **Reset-Test Switch.** "Reset" position silences audible signal and changes flashing light to steady until normal operation is restored. "Test" position permits periodic check of each element in the Visalarm.
- 5 **Compact and easy to install.** Occupies little space on the control panel. Only requires round drilled holes.
- 6 **Accessible** . . . all actuating devices are on a factory-wired, jack-mounted plate which can be quickly removed for servicing and a spare can be inserted to maintain operation.
- 7 **Two-light and three-light** Visalarms are available; any number can be mounted in either vertical or horizontal rows on a control panel. Type EKP Visalarm is explosion-proof and Type KP Visalarm is dust-tight and weather-resistant.

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*CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.

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(MIL-I-787A, 15 April 1952
superseding JAN-H-787 and
amendments)



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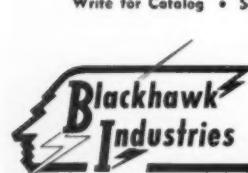


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shut down his welding machine, he would place the live electrode holder on the frame of the welding machine. If, when the machine was again started for the next work period, the operator did not immediately remove the live electrode holder from the frame, a short circuit existed for the secondary winding of the transformer as shown in Fig. 1. This short circuit current, in the order of 200 amperes, flowed in the No. 12 equipment ground wire in the feed cable. The equipment ground conductor would then so overheat as to burn its way through the feed cable.

As a solution to this problem, the use of a magnetic starter in the primary circuit of the transformer was developed. An open magnetic starter is mounted in the transformer case, with a start-stop pushbutton station for control. A small relay, with a 3-volt ac coil and 600 volt contacts, is also connected into this circuit as shown in Fig. 2. For the motor-generator type welder, the manual type starter must be replaced with a magnetic starter and the relay can be mounted in a square outlet box nipped to the starter.

The operation of this arrangement can be followed in Fig. 2. The equipment ground wire is connected to one coil lead and the other coil lead is grounded. The relay contacts are connected into the holding coil circuit. If a short develops with this hookup, the high short circuit current energizes the relay coil, opens its contacts, and de-energizes the magnetic starter holding coil, opening the primary feed to the transformer. In effect, the welder fails safely. Then by removing the electrode holder from the frame and pressing the start button, the machine is quickly restored to normal service. For simplicity, the start-stop circuit has been left out of the diagrams.

Seabees Simplify Pipe Threading

CONSTRUCTION

Pipe threading by hand-turning a big, heavy die is a construction task that builds a Seabee's muscles, but speed and manpower are critical items in the Far East, reports Walter F. Oakes, AKCA, Commander Fleet Air, Japan. Why not develop a "pipe-threading mule" to turn the die faster at less effort and release skilled Navy Seabees to tone up their muscles on other important work?

So thought the utilities crew of Mobile Construction Battalion Two at the U. S. Naval Air Station, Atsugi, Japan. They consulted their own



BUILT TO BEAT HEAT

**Cutler-Hammer's answer to the
unavoidable internal heating
that causes Safety Switches to fail.**



Engineering research authenticated by outstanding authorities has conclusively established "internal heating" to be the principal cause of safety switch failures. This "internal heating" literally bakes the life right out of safety switch parts, causing insulating materials to disintegrate and metal parts to distort and corrode. The safety switch then either becomes inoperative or it "burns up" through inability to carry the load.

In properly constructed safety switches, fuses are almost entirely responsible for this destructive "internal heating." This is not a criticism of fuses for any fuse operating up to its rated load *must* be near its melting point if it is to

perform properly when an overload occurs. And any metal operating *near* its melting point *must* be hot . . . and fuse links are hot . . . with temperatures running as high as 700 degrees Fahrenheit.

Since you cannot vent trapped heated air through a safety switch enclosure and still keep a safety switch safe, the only escape from the ravages of "internal heating" *must* come through the selection of materials for the internal safety

switch structure and the design of that structure to *withstand successfully the unavoidable heat conditions met in safety switch service.*

Cutler-Hammer Safety Switches were completely redesigned in this way a *dozen years ago* to beat "internal heating" when engineering research clearly indicated the need for *such* safety switches. Eleven years of experience shows the Cutler-Hammer claim of better safety switch performance far more than a mere promise; it is a proven *fact* that demonstrates why there can be no other answer in safety switch selection. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.



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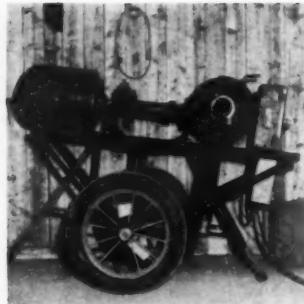
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PIPE THREADING at a U. S. Naval Air Station in Japan, formerly done by Seabees turning the huge dies by hand, is now done by this improvised motor-operated "mule", put together in their machine shop.

"improvisation and invention department"—their machine shop men, that is—and put in their order for the pipe-threading mule. Two weeks later they began enjoying the use of one.

To give birth to the mechanical mule, Chief Construction Mechanic Clark L. Fraser, who heads the machine shop, and George Rapoza, construction mechanic, first class, welded together a supporting frame or carriage out of 14-inch (O.D.) steel pipe and gave it mobility with two pneumatic-tired wheels from a concrete buggy.

Atop the carriage at one end is mounted a 3-hp, 3-phase electric motor. The motor's 875 rpm's are geared down to 87.5 rpm to turn a 12-inch-long "stub" of a drive shaft going into a GMC truck rear axle, where the rpm's are further reduced to 14.5. At either side of the axle housing are sockets into which a loose shaft may be installed for turning at a right angle to the lengthwise direction of the mule carriage.

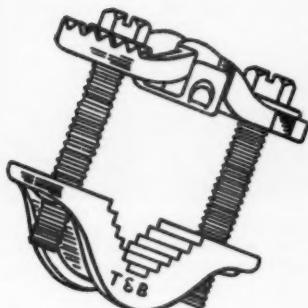
Each end of the loose shaft has a universal joint. When a pipe-threading die has been placed on the end of a length of pipe, one end of the shaft is inserted in the ratchet drive socket of the die, and the other end is joined to one side of the axle housing on the mule carriage. The electric motor then is switched on and the "mule" gets to work and cuts the threads. A Seabee stands by and keeps the die well oiled as the mule turns it on the pipe.

From 2½-inch to 6-inch diameter pipe can be threaded by this mule and in one third or less the amount of time that is required for a man to turn the huge dies by hand.

Miles and miles of steam lines and water lines are being installed by the Seabees at the air station, and there's little need to add that the pipe-threading mule gets little rest.



You can handle any grounding job with 10 Standard T&B Engineered Parts!



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Combinations—IN SECONDS!**

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You can run *conduit-protected* ground wire through any conduit size from $\frac{1}{2}$ " to 1"—and ground both conduit and wire to any water pipe from $\frac{1}{2}$ " to 6". Just combine the conduit hub and water pipe clamp you want.

You can ground #8, 6 or 4 *armored* wire to the same range of pipe sizes. Just bolt an armored-wire hub to the right size clamp.

Or you can attach #8, 6 or 4 *bare* wire to the solderless grip on the clamp—no hub needed!

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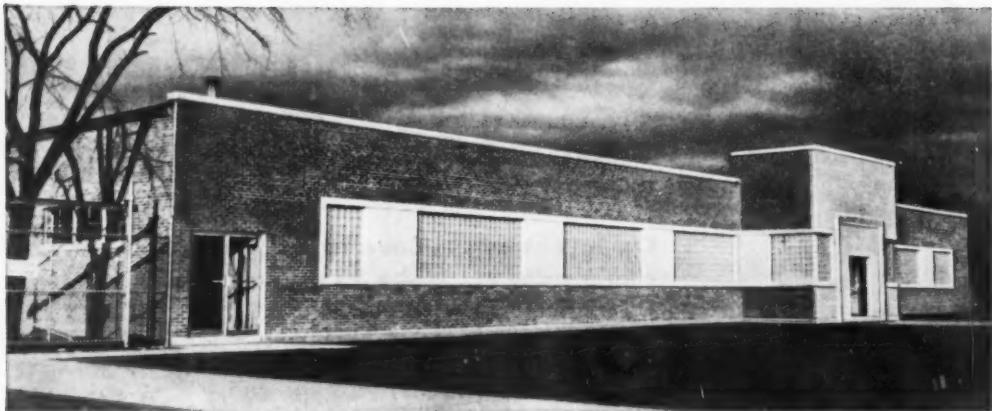
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Planned **TODAY**— for electrical availability —**TOMORROW**

The Marlin-Rockwell Corporation's new building is equipped with G-E Fiberduct which permits future electrical changes. G-E Fiberduct gives the advantage of raceway coverage for today's electrical needs *plus* the provision to meet tomorrow's unforeseen demands for changing floor layouts or expanding electrical services. In fact, Fiberduct underfloor raceways permit complete freedom in arranging desks, benches, or machines. They make service outlets available throughout the floor area—anywhere along the duct line.

At any time during the life of the building, new outlets for power, signal, or telephone facilities can be added quickly—merely by making a small opening in the floor over the raceway, pulling the wires through, and installing the outlet. If more electrical capacity is needed, additional wire can easily be pulled through the raceways. These changes in electric service can be made quickly without disturbing the building's tenants or operations.

Plan on G-E Fiberduct, the non-corrosive underfloor raceway, for electrical availability in your buildings. Write for more information or a free copy of the G-E Fiberduct Manual to Section C3-1018, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

Marlin-Rockwell Corporation Building, Plainville, Conn., contains 17,000 feet of G-E Fiberduct to provide raceway coverage for present needs and for future electrical changes.

Architect and Engineer: Marlin-Rockwell Corp.

Electrical Contractor: Joseph McNellis & Son, Waterbury, Conn.

General Contractor: Frank E. Downes Construction Company, New Britain, Conn.



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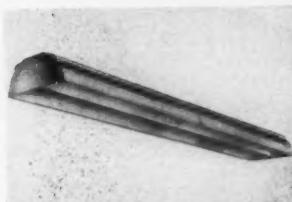
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Product News



Industrial Lighting Fixture (1)

A new industrial lighting fixture known as "Day-Flo Upliter". It is for use with a single pin or bi-pin fluorescent lamps. Approximately 28% of the total fixture distribution is upward and 72% downward. 35° crosswise shielding of both lamps reduces glare to a minimum. The design permits a constant flow of air to circulate through the fixture, reducing dust accumulation. They are for either individual or continuous mounting. Provision is made for sliding clamp hangers, conduit stems or chain hangers.

Wheeler Reflector Company, Boston, Mass.



Gear Motor (2)

A new gear motor designed to simplify maintenance in case of electrical failure of the stator. It is built in three pieces to permit removal of defective stators without disturbing gear components or gear connections to load. Design includes a G-E Tri-Clad motor; a planetary gear; and a mechanical adapter. Gear is available in speed ratings of 780 to 13.5 rpm. Openings for motor ventilation are provided at the bottom. Motor is available in ratings of 1 to 75 hp for standard applications and up to 200 hp for special applications.

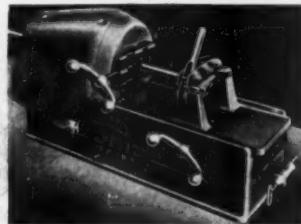
General Electric Co., Schenectady 5 N. Y.

Wiring System (3)

Plugmold 2000 is a new multi-outlet system that provides convenience outlets every 30 inches in a continuous run. A single raceway has been designed to

accept all three wiring services: the raceway cover is holecut to receive Wiremold's pre-wired Snapicoil with NEMA grounded receptacles, duplex 2-wire receptacles, both "hot", or duplex 3-wire receptacles with one side switched and one side "hot". No special fittings are needed to feed Plugmold 2000. Knockouts for feed-in are provided every $1\frac{1}{2}$ inches along the base. Knockouts for wood screws are provided every 1/4 inch. It can be installed in any new building, or in the modernization of existing buildings, without tearing out walls, partitions, or floors. It is designed to blend into the wall surface on which it is mounted, and becomes a part of the baseboard and trim.

The Wiremold Company, Hartford 10, Conn.



Threader (4)

A new portable pipe, bolt and conduit threader. Alemite lubricated, the new Quijada Chief has a patented power-operated chuck, which eliminates the use of wrenches or other manual tools in handling the pipe. A flip of the switch and four jaws, front and rear, automatically grip and center the pipe. Fingertip control enables the operator to use the Chief for making up, as well as threading, cutting and reaming. It has a pipe or conduit range of $\frac{1}{2}$ to two inches; a bolt range of $\frac{1}{2}$ to $1\frac{1}{4}$ inches.

Quijada Tool Division, Gaines-Collins, 5474 Alhambra Ave., Los Angeles 32, Calif.

Brooders (5)

New infra-red brooders for 4, 3 and 1 lamps. The 4-light is for farm or broiler plant. Brooding capacity is 20 sq. ft. and accommodates 300-350 chicks. Wafer thermostat automatically controls two of four lamps and can be adjusted to regulate temperature so that lamps burn as needed. Steel reflector is 18 inches in dia. The three-lamp provides a heat pattern of about 16 sq. ft. and accommodates 250 chicks. The one lamp is for brooding poultry of all varieties, pigs, lambs, turkeys, calves, etc.

Jackson Electrical Company, 900-910 W. Van Buren St., Chicago 7, Ill.



Generator (6)

A new portable engine-generator, Model 4500, is designed for full output at 115 volts, 60 cycles, ac. It has motor starting capacity of 4500 watts. Unit has 3000 watts intermittent rating and 2500 watts continuous rating. Klixon thermostatic cut-out switches with manual reset protect generator from overload and overheating. The cast iron outlet box located on top of generator provides a voltmeter, and one 20 ampere capacity and two 15 ampere capacity twist-lock type outlets wired in parallel. Available with either standard tubular cradle base or "Speedy-Shift" portable base.

Wincharger Corporation, East 7th and Division Sts., Sioux City 2, Iowa



Cable Clamp (7)

A new Sky-Tie clamp has been developed for doubles. Known as the "Duplex" fitting, it assembles inside the Sky-Tie and accommodates two pieces of cable. The excess cable loops through it. In foundries, defense plants, automotive industries, etc., where power is transmitted by means of bus duct and bus drop cable, the Sky-Tie clamp serves both as a support at the overhead point of suspension, and as an anchor at two points of the installation—at the busway and at the machine tool. It is a two-piece device, joined by two bolts. A spring at the point of suspension fits onto the Sky-Tie tangentially to its bend, tying back to a structural member to insure tautness of cable and to absorb vibration and shock.

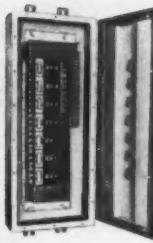
The Adaleit Manufacturing Company, 14300 Lorain Ave., Cleveland 11, Ohio.



Midwest Electric Mfg. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

1639 W. WALNUT STREET
Chicago 12, Illinois



Panelboard

(8)

A new type DTP dust-tight and weather-resistant panelboard which will accommodate up to eight three-pole, 100-amp, 600 volt circuit breakers. Suitable for use in Class II hazardous (dusty) locations. Panelboard consists of a rectangular cast aluminum enclosure with gasketed cover and dust-tight and weather-resistant external operating mechanisms for circuit breakers. Ample gutter space is provided at both ends and sides. Panelboard can be arranged for either top or bottom feed. Enclosure walls are sufficiently thick to permit drilling and tapping for branch conduits anywhere in ends or sides.

Crouse-Hinds Company, Syracuse 1, N. Y.



Luminaire

(9)

"The McKinley," a new 4-foot luminous-indirect 4-lamp slimline luminaire, is for use in schools, office buildings, drafting rooms and other applications requiring a unit of low surface brightness. It is 16 5/16-in. wide and 4-in. deep. The combined side and bottom panels are of white, ribbed polystyrene, reinforced by a narrow longitudinal strip. Units are pendant mounted with Pittsburgh "H" Series hangers which include end, junction and clevis hangers.

Pittsburgh Reflector Co., Oliver Building, Pittsburgh 22, Pa.

Wire and Cable

(10)

"Nepconol" is the new trade name selected by National Electric Products Corp. for its expanded line of Thermoplastic insulated wires and cables, including building wires. It replaces the former trade name of "Neon". All thermoplastic insulated wires and cables produced by

National in the future will be marketed under the name "Nepconol", including Type T, used in "Loomwire" non-metallic sheathed cable; Type TW, for use in wet locations in place of lead encased cable, and three "hot-spot" wires, one for operating temperatures of 80°C, and two new high temperature types. Also to be produced under the new name are fixture wires in Types TF (solid or stranded) and TFF (flexible) for 600-volt service up to 60°C.

National Electric Products Corp., Chamber of Commerce Building, Pittsburgh 19, Pa.

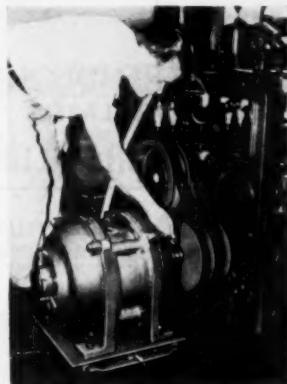


Radiant Heater

(11)

A new line of ceramic radiant heaters for industrial or home use, available in permanently installed wall mounted types or portable units. High-resistant Ni-chrome wire is imbedded in the ceramic panel. PK series, illustrated, is for permanent installation, extends 2 inches from wall, and obtainable with built-in or remote thermostat, with ratings of 4.5 or 9 amps, 115 or 230 volts. The T series, wall mounted, and the portable A series are rated at 9 amps, 115 volts, 1000 watts. U.L. approved.

Heatmore, Inc., 738 Broadway, New York 3, N. Y.



Variable Speed Drive

(13)

A new variable speed drive incorporating the Taper-Lock principle. Components of this speed drive are: (1) a variable pitch motor sheave; (2) a set of wide range belts; (3) a companion sheave; (4) a slide motor base. The Taper-Lock principle is used in the bushings for both sheaves. Variable sheave assembly locks on motor shaft as a unit with the turn of a screw. Pitch diameter is changed by means of a one-point adjustment. Belts are Dodge Sealed-Life belts, having deep side walls. Slide motor base permits changes in center distances. It is compact, of flush design, and is available in a full range of sizes for NEMA frame motors.

Dodge Manufacturing Corporation, Mishawaka, Ind.



Speaker Housing

(14)

An explosion-proof speaker housing for use in hazardous locations where explosive gases and vapors are present. Housing MI-12425, fits all RCA horns and several diaphragm-type speaker mechanisms. It is approved by Underwriters Laboratories, Inc. and will withstand an internal gas explosion. Housing introduces a tortuous sound path between the speaker diaphragm and the horn. This path serves to extinguish any flame generated within the mechanism before it reaches the horn or the outside atmosphere. Housing is made of cast aluminum, with a nickel plated brass ferrule which holds the mounting nut and houses the sound path. Unit is 8 inches in diameter and 7 1/2 inches high.

Radio Corporation of America, Camden, N. J.

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OF ALUMINUM WITH ALZAK FINISH. AVAILABLE FOR WIDE BEAM OR NARROW SPREAD, FOR 500 WATT AND 1000 WATT LAMPS.



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**WHITE PORCELAIN
ENAMELED STEEL
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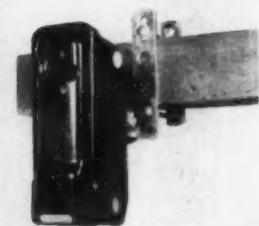
**SEND FOR
COMPLETE
CATALOG**

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ELECTRIC MFG. INC.

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Cutouts

(15)

New heavy duty cutouts, rated 5.2 kv, 100 and 200 amperes, with higher interrupting ratings. They will interrupt short-circuit currents of 8000 amperes at 5 kv and 12,000 amperes at 2.5 kv. The new 100-ampere heavy duty cutout can be distinguished from standard duty cutouts by the reflector on the cutout door. Day or night, this reflector is visible from the ground.

General Electric Co., Schenectady 5, N. Y.



Cable Cutter

(16)

A new portable, hydraulic cutter for cutting insulated electric cable and armored cable up to 3½ inches O.D. Called "Guillotine" model 30-D, it is available with a choice of three portable pump units. Model illustrated is shown with the air-hydraulic pump assembly that operates off any source of compressed air supplying 100 lbs. pressure. It is also available with an electric hydraulic pump assembly for 110 volt or 220 volt. Unit can be supplied with a separate hand pump assembly for work in the field.

Manco Mfg. Co., Bradley, Ill.

Signaling System

(17)

The Quik-Call selective signaling system and the "Handie-Talkie" radiophone, have been combined to form a radio call box. It is designed to provide 2-way communications between a central office and selected fixed and mobile outputs. Operating without wireline interconnections, the device will provide voice communications for public safety, civil defense, industrial and commercial operations. When the central station operator wishes to communicate with a patrolman or guard in the vicinity of a particular radio call box,

he selects that box by transmitting the associated selective signal. Upon reception of the signal, a red light on top of box pole lights. The patrolman responds by unlocking the call box and signaling the central station. The "Handie-Talkie" unit is supplied by a 117 volt, 60 cycle ac line while installed in call box. As unit is removed from box, it is automatically switched to its self-contained battery power supply.

Motorola Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.



Ceiling Straps

(18)

A new adjustable ceiling strap for single stem lighting installations. It can be mounted with either one or two toggle bolts, and has a maximum adjustment of 2 inches for out-of-line compensation. It is one assembly, rust proof zinc plated, 16 ga. steel with a distortion point of 400 pounds. Strap will go on a ceiling outlet box stud or other preset stud. It is equally adaptable for fluorescent or incandescent single stem hangers.

F. W. Wakefield Brass Co., Vermillion, Ohio



Motor

(19)

A lightweight Vardivide motor Type 5 VA, in fractional horsepower equipped with mechanical remote control. The control feature includes a control hand-wheel with indicator dial and a 5-foot flexible cable so that operator can control the Vardivide's speed distant from the motor. The dial indicator is a part of the control, making it unnecessary to go to the motor to see what speed is being "revved up". Motor is available in $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{1}{4}$ hp and in a speed ratio up to 10 to 1 over a range of 4 to 10,000 rpm.

U. S. Electrical Motors, Inc., Box 2058
Los Angeles 54, Calif.

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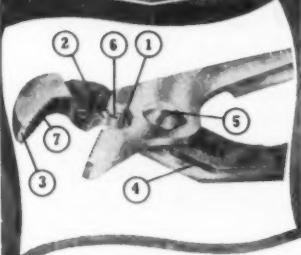
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Here is a plier that will last for years! Channellock Pliers—made only by Champion DeArment Tool Co., Meadville, Pa.

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Instrument (20)

The Ampprobe "300" is a new pocket-size volt-ammeter with nine ranges up to 300 amps and 600 volts. Instrument is of the "snap-around" type, which enables user to measure current without shutting down equipment or making ammeter connections. The nine ranges are 0-6/15/30/0/150 300 amp ac, 0-150/300/600 volts ac. Voltage test leads are equipped with new retractable safety plug, which automatically insulates itself when removed from meter. Probe jaws are pointed for working in crowded switch and terminal boxes.

Pyramid Instrument Corp., Lynbrook, N. Y.

Wire Connectors (21)

"DB" wire connectors have been added to the Dutch Brand line. They are available in four standard sizes and are made of phenolic material. They are U. L. listed and are proof against shorts, grounding and vibration.

Van Cleef Bros., Inc., 7800 Woodlawn Ave., Chicago 19, Ill.

Mat Switches (22)

A new line of Switchmats, extended area electrical switches in the form of



sheets or thin mats. Available in any size or shape from 2-in. by 2-in. to 36-in. by 144-in., these SPST switches are actuated by pre-determined pressures ranging from a few ounces to several tons. Only 3/6-in. thick, they can be used on floors, platforms, stair treads, etc., without obstructing foot or vehicle traffic. Foot pressure on any part of the area covered by the mat closes the circuit; release of pressure opens it. Mats are hermetically sealed against moisture and weather between vinyl, rubber or neoprene. Switchmats can handle up to 1 ampere at 110 volts directly, and control the operation of high voltage high current devices when used in conjunction with control boxes. Available controls cover types for temporary and permanent installation and provide instantaneous and delayed action.

The Recora Company, 7419 S. Western Ave., Chicago 36, Ill.



Lampholder (23)

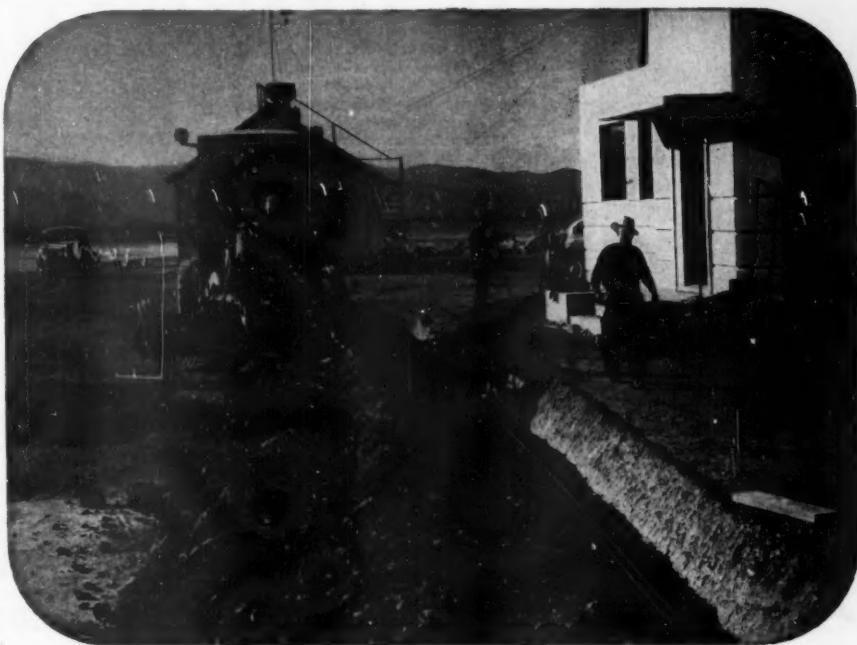
A weatherproof lampholder, known as Cushion-Seal Holder, is for outdoor lighting. The new type of holder makes use of high temperature, silicon rubber cushion-seal that hugs the neck of the lamp in a tight weatherproof seal. The cushion-seal adapts itself to fit all R-40 and PAR-38 lamps whether long, short or off-center. It is made of non-corrosive cast aluminum with a glazed porcelain heatproof socket. The unit comes completely wired with lead wires extending beyond a universally adjustable swivel arm that is threaded $\frac{1}{2}$ inch IPS for mounting to $\frac{1}{2}$ inch pipe, wall bracket, pipe slip fitter, or any of a number of standard interchangeable splice box accessories. It carries UL and CSA-approval for use with medium base or mogul reflector lamps in standard 150, 200, 300 and 500 watt sizes.

Stonco Electric Products Co., 333 Monroe Ave., Kenilworth, N. J.

Hanger (24)

A new Fast-Lock hanger for non-metallic outlet boxes. Hangers consist of two telescoping channel-sections, carrying a Fast-Lok Snap-On fixture stud or button to grip the box through a knockout hole. Two sizes of hangers cover the full range of 11-inch to 24-inch between centers of joists, studs, beams or rafters. The button, for attaching a box only, or the stud, which is threaded to accept a standard $\frac{1}{4}$ -inch fixture-extension nipple, rides in a slot so that it can be positioned any-

PARKWAY CABLE



Save the cost of duct systems...with the most dependable Parkway Cable you can buy!

ROEBLING'S research staff is continually working at the job of product development. Our manufacturing facilities and techniques are constantly improved. That's why our Parkway Cable for distribution and general power supply circuits is today even more dependable than ever before.

Roebling Parkway Cable saves money right from the start because it is buried directly in a shallow, low-cost trench. It is made in single and multiple conductor — solid or stranded — in a range from

600 to 5,000 volts...furnished with metallic armor or a non-metallic *Roeprene* sheath, depending on the physical protection required. Types that pass all C.A.A. requirements for Specification No. L-824 for airport lighting are also available.

Large quantities of Roebling's full line of electrical wires and cables are needed in the rearmament program. We and our distributors will do everything possible, however, to meet your requirements. John A. Roebling's Sons Company, Trenton 2, N. J.

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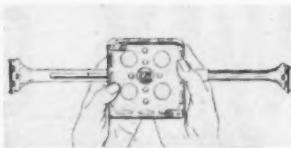
They'll save time and money on job after job—drilling anchor bolt holes in concrete and masonry, channelling and cutting holes through walls and floors for pipe and conduit, scaling rust and old paint.

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Operate from 110 volt or 220 volt A.C.

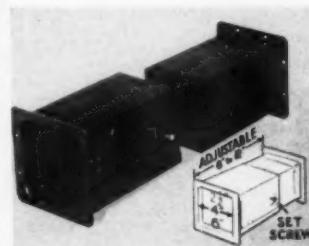
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Hartford, Conn. 06101



where between structural members and locked with the turn of a screw. There are two main types of hangers: one, for wood-frame building, has broad endplates with prong grips and nail holes. The other, for use in steel-frame buildings and on supporting channels of hung ceilings, has two long, metal tie-straps at each end to be wrapped around the hung-ceiling channels or other structural members. Both types are available with buttons or fixture studs for either metallic or non-metallic boxes.

*Fast-Lok Manufacturing Co., Ash St.
at Bedford, Bridgeport 5, Conn.*



Fittings

New telescope fittings have been added to this line. They are brake formed from 16 gauge steel, and are painted for rust resistance. They are furnished for 2½, 4- or 6-inch wireways, and are adjustable in length from 8 to 12 inches. Set screws lock them in place when they have been adjusted to desired length. Bolt holes are pierced through flanges.

*Keystone Manufacturing Co., 23328
Sherwood Road, Centerline, Mich.*



Recessed Downlight

A series of square recessed Perma-reflectors downlights for 200 or 300 watt lamps. When installed, the entire unit recesses into the ceiling, except for the one-piece, hinged frame. Concealed hinge and latch give the frame a smooth appear-

ance. Internal baffles prevent light leakage around the frame. A "finger-pull" permits quick opening when re-lamping or cleaning is necessary. Concentrating and extensive Corning lenses and a Corning lensed bowl are available to provide for a wide range of applications.

*Pittsburgh Reflector Company, 404
Oliver Bldg., Pittsburgh 22, Pa.*

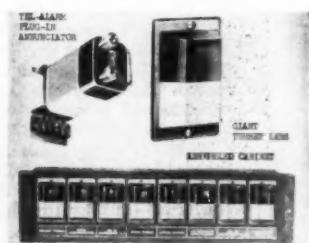


Insulation Tester

(27)

A new Model P-1 plug-in type Megohm insulation tester for portable or bench use. It is built into a hardwood case with removable cover for use on test benches and also has a carrying handle for portable use in locations where 115 volt, 60 cycle line supply is available. A feature is the 5 inch mirror scale, individually calibrated and hand drawn for maximum accuracy. It has a true ohmmeter movement which is independent of voltage variations. It is provided with a self-contained power unit to step up and rectify 115 volt 60 cycle ac supply. Output voltages of 500 volt dc and 1000 volt dc are available. Ranges available are 100 or 1000 or 2000 megohms.

*Herman H. Sticht Company, Inc., 27
Park Place, New York, N. Y.*

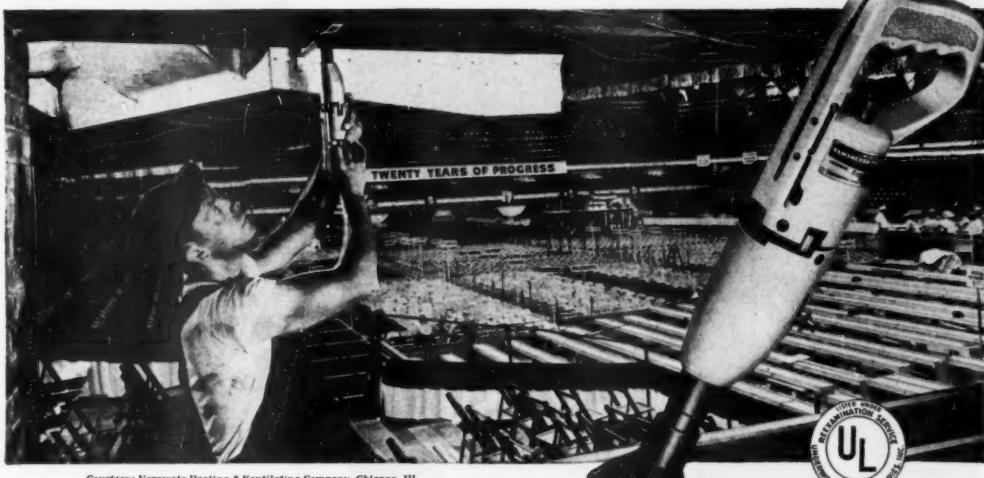


Turret Lens

(28)

A new giant turret lens has been developed for the Tel-Alarm annunciator signals. They are made of a plastic material with a wide choice of colors available. Each lens has two sections which correspond to the two lights of the Tel-Alarm signals. Upper portion is one color and lower white frosted. With these lens on annunciators it is possible for operator of control room to see at a glance which alarm signal is

CUTS DUCT INSTALLATION TIME 50% IN AIR CONDITIONING INTERNATIONAL AMPHITHEATRE



Courtesy: Narowetz Heating & Ventilating Company, Chicago, Ill.



Listed and approved by
Underwriters' Laboratories

New Cartridge-Powered MODEL 450

REMINGTON STUD DRIVER

Despite a close deadline, ductwork was installed in time for both political conventions by the Narowetz Heating & Ventilating Company of Chicago... with the help of the Model 450 Remington Stud Driver. This revolutionary tool's speed and efficiency saved time and cut costs.

The Model 450 is completely self-powered and engineered for safety... sets as high as 5 studs per minute in joining steel and wood structural pieces to concrete and steel surfaces.

Test-proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., America's oldest sporting arms manufacturer. Price for Model 450, complete with rugged steel carrying case—only \$119.50. For further information, fill out and mail the coupon.

"If It's Remington—It's Right!"

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*It's
fast, easy and
safe to operate
the Remington
Stud Driver*



*Simply hand-assemble
stud and power cartridge,
load as a unit in easy-
to-open Remington Stud
Driver and close.*

*Then press loaded Stud
Driver firmly against
work surface, depress
safety lever, and pull
trigger. Explosive charge
embeds stud solidly.*

Remington Arms Company, Inc.,
Industrial Sales Division, Dept. EC-10
939 Barnum Ave., Bridgeport 2, Connecticut

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flashing. The turret lens also affords more clearance for the light which fits inside it.

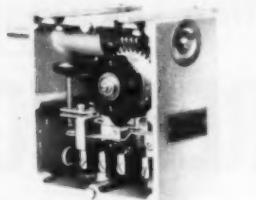
Tigerman Engineering Co., 4332 North Western Ave., Chicago, Ill.



Portable Platform (29)

A new portable working platform called Hi-Lift Midget. It extends from 46 inches high to 84 feet, giving a working height of 15 feet. The base measures 27 inches by 40 inches. Unit comes in one piece with no erection required. It is of welded steel construction and is ideal for all overhead maintenance, painting, lighting, cleaning etc.

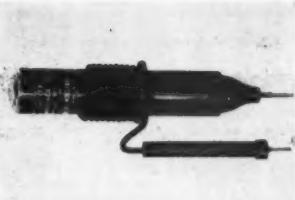
Atlas Industrial Corp., 819—39th Street, Brooklyn, N. Y.



Switch (30)

A rotating limit switch to limit the travel of rotating parts of machines or equipment such as electrically operated doors, hoists and valves. This type switch coordinates reversing operations with the rotation of the motor shaft, or other operating shaft, to break contact, timing of which is governed by a pre-set number of shaft revolutions. Mechanism consists of two separate switching units each operated by a cam. These cams engage with contact arms to open or close a circuit for each end of travel and are mounted on either side of a die-cast gear which is driven by a worm gear attached to a shaft operating through the switch case. Overall size is 6 1/8 in. high, 3 3/8 in. deep and 5 3/8 in. wide; steel operating shaft extends 2 1/2 in. from case.

Furnas Electric Co., 1067 McRae St., Batavia, Ill.



Voltage Tester

(31)

A new voltage tester having only one test lead, is called the "Hi-Test", and indicates ac or dc voltage from 115 to 600 volts. The second test prod is permanently mounted in one end of the tester, making it easy to hold the tester in one hand and still press prod against contact or wire. Voltage scale is located in end of tester opposite prod, where it is in full view. It is a drum type scale, covered and protected with a magnifying lens. Overall length is 8½ inches; test lead with 4 inch plastic handle, 48 inches.

Holub Industries, Inc., Sycamore, Ill.



Bar Hanger

(32)

The new PM No. 1000 all-purpose adjustable bar hanger can be installed in 20 seconds. It eliminates all joist or stud notching and nailing. A marked guide leg is on both ends for lining up boxes for plaster line finish. Adjusted for installation between 12, 16 or 18 inch centers by a series of marked slots through which a hanger flange is inserted while hanger is broken open, then snapped shut by hand pressure at center. This locks hanger and forces sharp pointed end prongs into wood joists or studs installing hanger in place.

PM Electrical Products Co., 203 North Wabash Ave., Chicago 1, Ill.

Power Cable

(33)

Super Coronol power cable for service up to and including 8000 volts is now rated at 85 C copper temperature. The new temperature ratings mean that Super Coronol cables are now capable of carrying up to 12% more power, continuously, than old-style ozone-resistant rubber-type compounds rated 75 C maximum. The new rating can also be applied to all Super Coronol cable now in service at potentials up to 8000 volts. For voltages above 8000, ratings continue to be based on 80 C.

General Electric Co., Bridgeport 2, Conn.

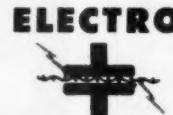
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ELECTRO'S SuperSeven

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- ✓ Excellent thermal conductivity
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MARTINDALE GROWLERS

PORTABLE GROWLER TYPE U-2



This Universal Adjustable Growler may be used as both an external Growler for armatures and an internal Growler for stators. It will test armatures from 2" diameter up, and stators from 5 1/4" diameter up.

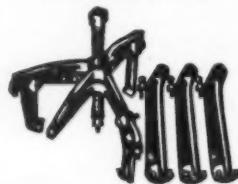


ADJUSTABLE BENCH GROWLER

Has adjustable jaws with face length of 2 1/2". With jaws closed will test armatures as small as 1" diameter. With jaws open, will accommodate armatures as large as 18" diameter.

Both types available with or without meters. Also six other models.

MARTINDALE WHEEL AND GEAR PULLER



Adjustable arms pull straight without squeezing the work. Set screws prevent spreading.

Made in 2 Styles and 4 Sizes up to 24" diameter.

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MICA UNDERCUTTERS FOR SLOTTING COMMUTATORS



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Write for 64-page Catalog describing these and many other products for Industrial Maintenance, Safety and Production.

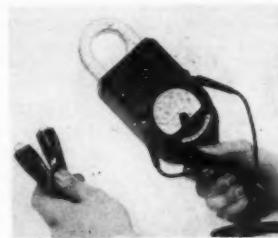
MARTINDALE ELECTRIC CO.
1309 Hird Ave. Cleveland 7, Ohio

Instrument (34)

This electrical indicating dynamometer can be made to operate electrical warning signals, relays, motors, switches, etc. It can be set for any loading point between 0 and 100,000 lbs. A 5 or 10-inch diameter dial is optional. Dial is protected with shatterproof safety glass crystal. It is overload protected. Unit is rustproof and moisture proof. Lead wires may be connected directly to a power source and thence to the object to be controlled. Some uses for this instrument are in automatic batching machines, warning signals to prevent overloading of cranes or hoists, static load testing of aircraft assemblies.

W. C. Dillon & Company, Inc., 1421 South Circle Ave., Forest Park, Ill.

Instrument (37)



Instrument

A redesigned hook-on volt-ammeter with higher voltage and current ranges and a new pointer-stop mechanism. Designated type AK-1a, it will measure ac instantaneously on five scale ranges: 0-7.5/30/75/300/750 amperes. It can be used on both insulated and non-insulated conductors by hooking it around the power line. Instrument will also measure ac voltage on three ranges: 0-150/300/750 volts. To use these ranges, the terminals are connected to the line, and a positive-action selector switch is turned to the desired scale. The "hook-on" portion is a split core transformer with its secondary winding tapped for different ratings and connected to a rectifier instrument through a range-changing selector switch. The instrument is shielded magnetically.

General Electric Co., Schenectady 5, N. Y.

Lighting Fixture (35)

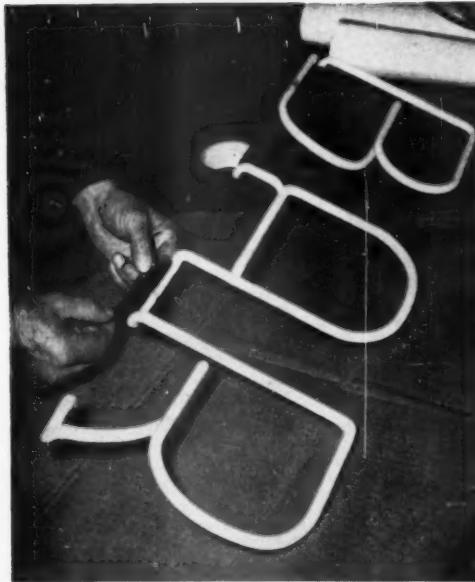
Improvement design features have been incorporated in the new Silvray Super 1500 incandescent lighting fixtures. Fixtures are built around the silvered-bowl lamp and are made as ceiling or pendant-types in 150 to 200 watt, 300 to 500 watt and 750 to 1000 watt sizes. Quick installation of the unit to a ceiling outlet box is provided by a six-inch diameter canopy with a "cam-ratch" locking device. A gimbal ring type "univertical" aligner with 45° of movement permits unit to hang vertically plumb from the ceiling. The pendant model has a threadless stem and husk joint that permits on-the-job shortening of stem without disassembling and rethreading it on a workbench. It is for use in schools, libraries, hospitals, drafting rooms and offices.

Silvray Lighting, Inc., Bound Brook, N. J.

Toggle Switch (38)

A new hermetically sealed precision toggle switch whose performance and operating characteristics are unaffected by environmental conditions. Designed especially for aircraft, it can be used in a wide variety of installations for which other switches are unsuitable. It will deliver its full electrical rating and operating characteristics without regard to changes in atmospheric pressure or temperature, and will not be affected by the pressure of corrosive atmosphere, dust, dirt, oil or water. Its vapor-proof character prevents condensation on switch contacts. The basic switch has a single-pole, double-throw contact arrangement.

WEATHERPROOF TAPE replaces outdoor paint



Permanent blackout! Polyken Tape No. 214 is used to black out sections of neon tubing quickly and permanently.

Neon sign maker solves costly maintenance problem on outdoor installations

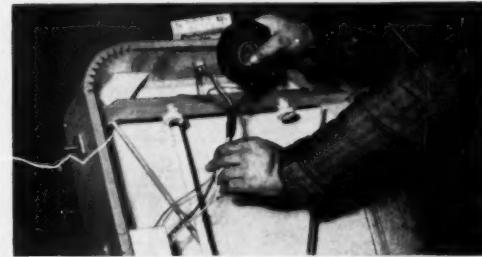
Appleton Neon Sign Co., Wisconsin, used to black out non-illuminated sections of neon tubes with paint. But the paint would weather off, and the blacked-out sections began to light up, creating a troublesome and expensive maintenance problem.

The answer was simple and effective: use black weather-resistant Polyken Tape No. 214 instead of paint.

Then for splicing high-voltage electrodes, the sign



Long-life splices. Electrodes that will carry more than 6,000 volts are spliced with Polyken No. 822, which has a 10,000 volt dielectric strength.



This inside job of bundling wires is made-to-order for low-cost Polyken Tape No. 163.

company switched from a vinyl plastic tape to Polyken's exclusive Polyethelene Tape No. 822. The change not only cut costs but also resulted in higher dielectric strength (over 10,000 volts) and greater insulation resistance (over 1,000,000 megohms) at the same time.

Finally costs were cut still further by a switch to Polyken Electrical Tape No. 163 for taping interior electric connections and holding wires for bundling.

These tapes are just three of a complete line of Polyken pressure-sensitive tapes made to save you time and money. Send for free samples and booklet today.

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For specifications, samples, and further information on Nos. 163, 214, 822 and other Polyken Tapes, please send me your FREE BOOKLET, "Tape is a Tool."

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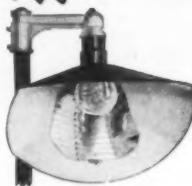
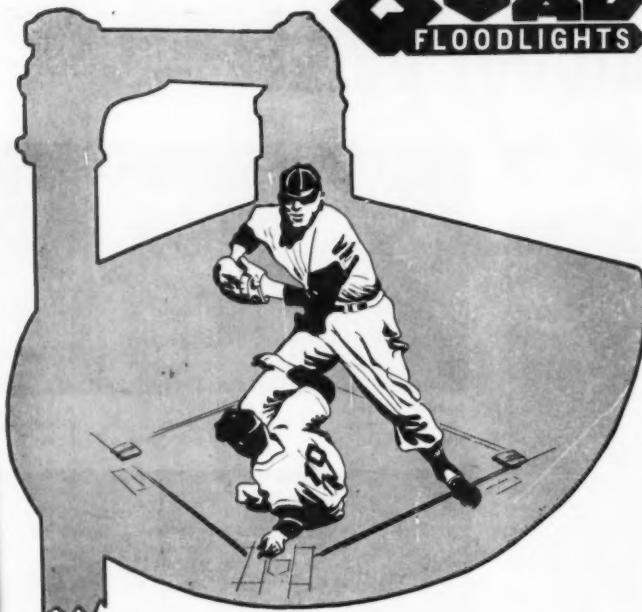
Company _____

Street Address _____

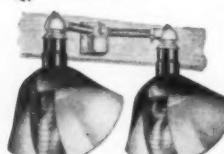
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QUAD
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QUAD Floodlights
adjustable to any
position Simple to install
and focus Easy Reflector to
Bracket mounting



• These units are easily installed and because of their flexibility your customers get the very finest in results. The exclusive QUAD Multiple Mounting saves time and labor. Another feature is the adjustable head which gives individual light control. A single head bolt permits adjustment of 180 degrees horizontally and 40 degrees vertically.

QUAD Floodlighting engineers are available to make recommendations.

Sold through Electrical Wholesalers

QUADRANGLE MFG. CO.

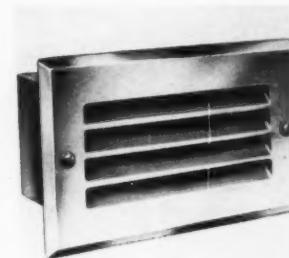
325 S. PEORIA ST.

CHICAGO 7, ILL.



ment. Tentative electrical rating is given as 5 amperes motor load 30 volts dc; 10 amperes inductive load 30 volts dc; 25 amperes resistive load 30 volts dc; 1.0 ampere ac for any type of load, 125 volts ac.

Micro Division, Minneapolis-Honeywell Regulator Co., Freeport, Ill.



Aisle-Light

(39)

A new aisle-light that doubles for porch or interior night light. Finished in a soft gray baked-on-enamel, the housing is $3\frac{1}{2}$ inches by 7 inches by $3\frac{1}{2}$ inches, with a covering louvered face plate $5\frac{1}{2}$ inches by $8\frac{1}{2}$ inches, with glass behind louvre. Fixture is U. L. approved.

Pressteel Company, 800 Bancroft Way, Berkeley 2, Calif.



Heaters

(40)

Automatic thermostatic control has been added to the 1000-1500 watt 240

series of wall-insert Heetaires. The control dial is set at the temperature wanted and it turns the Heetaire on and off as needed. Series 240 is also available with manual control. They have polished chromium plated reflectors and are available in chrome, ivory enamel or brown enamel finish.

Markel Electric Products, Inc., and La Salle Products, Inc., Buffalo, N. Y.

Fire Alarm System (41)

A new home fire alarm system called "Sav-A-Life" has been developed. A detector cell is installed in each room, close to the ceiling and an alarm bell near the master bedroom. Silver alloy contact points of detector cells are pre-set at factory to function at 115°F. Should a fire start any place in the house, heat rises, sets off detector cell, which in turn rings the alarm. Can be used to protect outbuildings such as barns, chicken houses, garages, greenhouses, etc. Kit comes complete with 6 detector cells and mounting bases, 10 volt transformer, loud ringing bell, 100 ft. plastic covered wire, screws etc.

Products Specialties, Inc., 1016 North Ave. E., Cranford, N. J.

Product Briefs

(42) A new universal nipple chuck, "55", capable of threading $\frac{1}{2}$ -inch to 2-inch pipe has been introduced by Beaver Pipe Tools, Inc., Warren, Ohio.

(43) Martindale Electric Co., Cleveland, Ohio, has announced a new Model H Mica-Miller portable **undercutter**, for operation on either ac or dc.

(44) A new universal **chain wrench**, which will grip round, hexagonal or square material has been introduced by Owatonna Tool Company, Owatonna, Minn. . . . (45) A heavy duty, self-contained portable **power saw**, called Sawzall, is being manufactured by Milwaukee Electric Tool Corp., Milwaukee, Wis.

(46) International Instruments, Inc., New Haven, has announced the production of a new $1\frac{1}{2}$ inch illuminated **panel meter**. . . . (47) Two new types of combustible gas alarms for fixed locations has been introduced by Johnson-Williams, Ltd., Palo Alto, Calif. . . . (48) An electric tubular **heater** has been developed by Edwin L. Wiegand Co., Pittsburgh, Pa.

(49) A new line-matching **speaker transformer** for use in multiple sound installations in schools, hospitals, hotels, factories, and other public buildings has been announced by RCA Sound Products Station of RCA Victor Division, Camden, N. J. . . . (50) Lightolier, Inc., New York City, has introduced four new **fixture** collections designed for indoor-outdoor use. . . . (51) Cleveland Process Co., Cleveland, Ohio, has announced the new electric immersion **heater**, called "Glorod".

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Catalogs, Bulletins and Engineering Data

(52) **Oil Purifiers** for protecting against oil failure in diesels, transformers, circuit breakers, switchgear and other oil-filled equipment are illustrated and described in 8-page booklet, including solutions to power interruptions, engine breakdowns and other problems resulting from contaminated oil. Honan-Crane Corp.

(53) **Steel Scaffolding**, including maintenance scaffolding, sectional steel scaffolding and allied equipment, material hoisting towers and elevators, is described in illustrated folder, with applications and specifications, showing rolling towers, scaffold jacks, various sizes of sectional scaffolding, mason's jacks, etc. Wilson-Albrecht Co., Inc.

(54) **SUPPORTING STRUCTURE** for cable trough, conduit, pipe and cables is illustrated and described in 8-page booklet, including specifications on the support pieces and accessories, typical applications and installation data. Rakit Corp.

(55) **PANELBOARDS** for mounting individual pole circuit breakers in the right-size enclosures are illustrated and described in 15-page booklet, including construction details of the enclosures and individual breakers, mounting and aligning of trim, installation method, specifications on the breaker, wiring diagrams and available enclosures. Federal Electric Products Co.

(56) **ELECTRICAL SYSTEM** for sewage and water level control and indication, used in wet wells, sumps, reservoirs, elevated tanks and standpipes, and for controlling pump motors, pump motor speeds, and for supervisory or alarm systems, is illustrated and described in 4-page bulletin. General Electric Company.

(57) **PHOTOELECTRIC SAFEGUARD** for protection against flame failure in commercial and industrial oil burning equipment, manually ignited oil burners, air heaters, ovens, kilns, etc., is illustrated and described in bulletin CA522, including data on the electric circuit, phototube and amplifying system. Combustion Control Corp.

(58) **CONNECTORS** and installation tools for full circumferential crimp of connector on conductor are illus-

trated and described in 8-page booklet, including analysis of circumferential crimping, specifications on crimping tools, and installation data. F. M. Anthony Co.

(59) **ELECTRICAL INSULATION**, Class H, made with Silicones, for motor rewinding, is illustrated and described in three bulletins, "Silicones in the Repair Shop", "Geared To Industry" and "More Power, Longer Life". Dow Corning Corp.

(60) **WIRING DEVICES**, interlocking type to prevent accidental disconnects, are illustrated and described in 8-page bulletin, including construction, design, application and ordering data on 20-ampere, 2-, 3- and 4-wire caps, connectors, plug bases, motor plugs and flush receptacles. The Arrow-Hart & Hegeman Electric Company.

(61) **SNAP-ACTION SWITCHES**, including safety, limit and interlock switches designed especially for switching ac circuits in industrial and commercial applications are illustrated and described in 24-page catalog 82. Micro Switch.

(62) **WIRE AND CABLE**, over 500 different types, including control and signal cables, railroad wire and cable, wire and cable for the building industry, for telephone and mine applications, and portable cords, are illustrated and described in 186-page catalog. United States Rubber Co.

(63) **MOTOR CONTROLS** catalog contains illustrated descriptions of magnetic starters, multi-speed and reversing starters, magnetic contactors and reversing contactors, manual starters, pushbutton stations and interchangeable control units, midget relays, limit switches and push-pull selector switches, including weights, dimensions, construction sketches and wiring diagrams. The Arrow-Hart & Hegeman Electric Co.

(64) **TROLLEY BUSWAY**, heavy duty, electric power distribution systems, for 250 - 375 - 500 amperes, are illustrated and described in 16-page catalog 30, including design and construction features, specifications, accessories, heavy duty trolleys and details on planning a trolley busway system. Feedrail Corp.

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KILOWATTS ARE CHECKED IN OVERLOAD AREAS



AK-3 SIMPLIFIES CAPACITOR INSTALLATION

1 Motor Starting Current Measured With NEW AK-1A Volt-ammeter

Now, with new pointer stop and additional voltage and ampere ranges, the new AK-1A hook-on volt-ammeter is an even more versatile a-c testing instrument. The pointer-stop permits reading of motor starting currents. You can use your AK-1A volt-ammeter for spotting overloaded feeders, open fuses, and improper operation of circuit breakers.

Ranges: 0-7.5/30/75/300/750 amperes
0-150/300/750 volts

Accuracy: $\pm 3\%$ full scale.

Extra-sturdy construction assures years of service.

Weight: 3½ pounds.

PRICE: \$66.75*

2 Check Kilowatts Directly With CompactAK-2 Hook-on Wattmeter

Both single and polyphase circuits can be measured quickly and easily with this hook-on wattmeter. Ideal for trouble-shooting power surveys and load tests, this instrument can be used to make sure that motors operate at rated capacity. In addition to measuring kilowatts, this AK-2 hook-on wattmeter will measure vars in balanced three-phase circuits.

Ranges: 0-3/6/20/60/200/300 kw
15-600 amperes
100-600 volts

Accuracy: $\pm 5\%$ full scale

Weight: 4 pounds.

PRICE: \$84.75*

3 Spot Power Losses Easily With Type AK-3 Power-factor Meter

This new hook-on power-factor meter enables you to measure power factor without interrupting service. The AK-3 can be used on any balanced 3-phase circuit. When making capacitor surveys, you'll find the hook-on power-factor meter a valuable time saver. Improved power factor means relief to overloaded feeder circuits and transformers.

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15-600 amperes

Accuracy: 0.05 PF

Weight: 4½ pounds

PRICE: \$84.75*

4 Quickly Determine The Phase Sequence of Polyphase Circuits

A handy, pocket-sized phase sequence indicator for determining the phase sequence of polyphase circuits is designed to save time for construction and maintenance men, trouble shooters, test men, and engineers. To use—merely connect the three leads to correct voltage terminals; one lamp will glow to show the direction of phase sequence.

Ratings: 120/240/480 volts or
120/240/600 volts

Weight: only 22 ounces

Dependable: has no moving parts or fragile filaments.

PRICE: \$28.14 OR \$31.77*



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5 Lighting Circuits Easily Measured By High Accuracy AC Portable

Used for both testing and maintenance work these compact high accuracy portables are ideal for lighting surveys. Small in size, they are easy to carry and store. Just the right amount of damping gives you maximum ease of reading. The AP-9 is available in almost all ranges as voltmeters, ammeters, milliammeters, single-phase wattmeters, and also with pointer-stop mechanism.

Accuracy: $\frac{3}{4}$ of 1% full scale for AP-9 (a-c)
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Weight: about 2½ pounds.

PRICE: \$53.00 AND UP*



ACCURATE TO WITHIN $\frac{3}{4}$ OF 1% OF FULL SCALE

6 Regulator Surveys Simplified With 30-day Type CF Inkless Recorder

With the Type CF Inkless Recorder one man can supervise the power requirements for an entire plant. Charts last up to 30 days; no ink to freeze or evaporate; available in a variety of voltage ranges; weather seal and temperature compensation permit use out-of-doors. Checking regulators or making plant surveys is made easy with this lightweight portable.

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The famous Sangamo Astronomic Dial functions automatically to control daily time switch operation in accordance with the time of sun-set and sunrise, compensating daily for the changing seasons. No periodic manual resetting is required.

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ST52-8

Reader's Quiz

Transformers

QUESTION L21—*We have a great many conventional oil filled distribution transformers scattered throughout our shops which have never received any attention except following actual failures. Would a program of routine inspections and oil changes improve our service? If so, what is recommended? We have never had any unusual number of transformer failures except as a result of lightning, even though many of our transformers have been in service over 20 years.*—D.H.N.

ANSWER TO L21—A program of routine maintenance on these transformers would prove helpful in that minor troubles could be spotted and repairs made before these troubles grew into major ones.

If the oil which you now have in your transformers has been in them a long time, I would suggest putting in new, and every three or six months check this oil for dielectric strength. If this dielectric strength shows it to be greatly reduced, then this oil should either be cleaned or replaced with new.

With a Megger, check the insulation resistance of primary and secondary windings and record this data. This should also be done at least monthly or else every three months depending on service. When the resistance begins to taper off, then it is time to have another transformer standing by to connect in place of the one showing the defect. Be sure that the transformers are disconnected from their power source before making the Megger test. Check the insulating bushings for a possible ground and all taped joints should be taken apart and checked for tightness and new tape put on.

Lastly, the transformers should be given a coat of paint at least once a year to add to their appearance and protect the cases from rusting. This paint should be of a type which is approved for use on transformers.—L.C.D.

ANSWER TO L21—One test advisable would be ohms resistance to ground or to frame from each winding. If the transformers are kept well sealed no moisture can get in the oil and it would not be advisable to tamper with them if the resistance to ground is in accord-

ance with the recommendation of the manufacturer. Keeping them free of dust and well ventilated is also important. Unnecessary oil changes might only introduce moisture and cause trouble.—C.J.

a voltage regulator on the circuit when it was used in a car, but does not have one now and so charges the battery at a high rate. What size rheostat would be suitable to cut down the charging rate to about 6 amperes? The present rate without any control is as high as 40 amperes.—E.E.M.

ANSWER TO N21—E.E.M. must be using a rather high amperage auto generator to get 40 amperes. I have direct connected auto generator— $\frac{1}{2}$ hp, ac motor, which I use for the same purpose. I have inserted "Power Clarostat—Variable Resistor" in the field circuit for the purpose of controlling the charging rate. This is a carbon pressure type rheostat and was designed for radio purposes. Its resistance varies from perhaps 20 ohms to almost zero. It serves very well to vary the charging rate from 2 or 3 amperes to 20 amperes. Of course it is not automatic, like a regulator on an automobile, but it has worked exceptionally well.—W.B.M.

ANSWER TO N21—A 100 watt, 100 ohm rheostat will work. Reducing the generator speed will also work, and be more efficient.—H.S.

Commutator Sparking

QUESTION P21—*We have a 300-hp, 230-volt dc motor driving a super calender. It's about three years old. Recently it started to chatter and the commutator seemed to get quite hot and colored. The brushes were originally furnished by the manufacturer of the motor. The mica is well undercut. The commutator seems to be in very good shape. I have stoned it, sanded it, and have set the brush pressure with scales, but I have been unable to stop this chatter. Could someone tell me what I could do to stop it?*—A.T.

ANSWER TO P21—This could be caused by loose commutator segments that do not show up until the motor is warm, incorrect setting of brushes around commutator with respect to commutating plane, or a short in one or more of the coils. Commutator segments that loosen up when the motor

Pressure Control

QUESTION M21—*Can I use a pressure control on a hot water boiler in order to prevent the water from flowing out when the temperature goes up too high?*—H.S.

ANSWER TO M21—It is presumed that the hot water boiler is part of an "open" system. Pressure is maintained by running a pipe to a small open tank at some distance above the boiler. Expansion of the heated water is carried from the tank by an overflow pipe. The major heating and plumbing supply houses can deliver a pair of inexpensive valves which automatically control the boiler water pressure. The valves are connected in tandem. One acts to fill the boiler water when the pressure drops. At the same time, water main pressure is reduced to conform to the normal boiler pressure. The second valve is a relief valve, opening only when pressure rises. A closed expansion tank is located at some convenient point, usually just above the boiler. Since this tank is airtight, and normally about one-third full of air, pressure variations between the valve settings are handled within the system itself. The valves and tank should be proportioned to the size of the boiler.—L.E.B.

ANSWER TO M21—You should use a temperature control or pressure control that cuts off the fuel before the temperature gets up too high. You must still have a pressure relief valve in case these controls fail.—G.J.

Generator

QUESTION N21—*We have an old 6-volt dc automobile generator connected to an ac motor for charging 6-volt storage batteries in the shop. Usually just one battery is on charge at a time. This generator is one that had*

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gets warm will do what is described, and if that be the trouble, they will have to be tightened in the shop. Incorrect setting of brushes in commutating plane will cause burning which will at times heat the commutator and the brushes drag and chatter. Brushes can be rotated back and forth until best setting is obtained under load; or a millivoltmeter hooked across the brushes and the field connected to a 2-6 volt battery through a switch. Close and open the switch by hand with the armature rotated by hand to several different positions. Note deflection of millivoltmeter for the different armature positions for different positions of brushes. Position that gives least deflection is the proper one. Short circuits in the armature can be checked by use of a growler or a low reading ohmmeter.—W.E.G.

ANSWER TO P21—Rough commutator, generally caused by unequal expansion due to heating. When such condition occurs, it may be advisable to use abrasive brushes to keep the commutator free from rough spots. The most difficult period in the operation of direct current motors, is the starting period. It is during this comparative short time, that the machine must accelerate, often under heavy load condition and come up to operating speed. Since the armature current (not the shunt field current) is usually much higher than normal, during this starting period, arcing at the commutator is likely to be severe. Unless the proper precautions are taken to prevent the destructive effects of such commutator burning, as well, as other serious electrical stresses, the motor will in time fail to operate due to a breakdown. Chattering of the brushes, which can generally be temporarily cured by cleaning the commutator with a piece of muslin with vaseline and a sure cure by changing the angle of the brush or change the grade of the brush.

—O.C.

Transformer Impedance

QUESTION Q21—*We have a transformer. The nameplate reads as follows: "Size 333 kva, voltage on high side 2400/4160Y, voltage on low side 240/480. Impedance 4.75% at rated volts, 75° Centigrade. With 2-1/2 percent taps above and below normal voltage."*

Does this mean that the impedance of 4.75% is correct regardless of what voltage tap is being used?—M.D.

ANSWER TO Q21—The nameplate impedance is 4.75% at rated volts.

AMPLEX

Sealed-Beam Reflector Lamps, Colorbeam Lamps, Spotlights and Floodlights, Industrial
Infr-Ray Heat Lamps, Vibration and Rough Service Lamps, Street Lighting Lamps,
Traffic Signal Lamps, Incandescent Lamps, Fluorescent Tubes, Display Accessories.

75°C, with 2-2½% taps above and below normal voltage.

This means that with the tap on normal voltage position and the transformer temperature at 75°C, with one winding short circuited, it will require 4.75% of normal voltage impressed across the other winding to force rated full load current through the windings of the transformer.

Actually, the impedance will vary above or below the rated impedance, by a slight amount when other than normal taps are used depending on the voltage impressed across the primary, the temperature of the transformer, and the design characteristics of the transformer.

If, for instance, the 5% tap above normal is used, only 95% of the high side coils would be used and the number of low side coils would remain unchanged. With 75% of normal voltage impressed on the primary (approximate working conditions when this tap is used), there is slightly less copper loss and slightly more iron loss. That is, slightly less resistance drop and slightly more reactance drop with the total impedance drop changed little if any, depending on the design characteristics of the transformer.—W.E.N.

ANSWER TO Q-21—The impedance of your transformer may be taken as 4.75% regardless of what voltage tap is being used. The following discussion should make this clear.

Impedance values are given on the nameplate of transformers for two purposes, the first of which is to determine whether particular transformers will operate in parallel. If you wish to operate transformers in parallel they must have the same percentage impedances, the same ratios of primary and secondary turns in the windings and the same ratios of reactance to resistance. Even identical transformers will not operate successfully in parallel unless they are set to the same voltage tap. This should be obvious, as the purpose of a voltage tap is to change the ratio of primary and secondary turns. Any change in impedance due to changing the tap will be the same on each transformer and therefore can be disregarded.

The second reason for stating percentage impedance on nameplates is to determine short-circuit currents, the determination of which in power distribution systems is just as important as the determination of load currents, and is in fact, a simpler calculation. However in making this calculation, certain assumptions have to be made, the principal one being the amount of short-circuit current fed back to the fault by rotating equipment such as induction motors and synchronous

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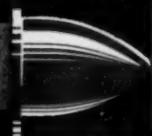
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2. IT THREADS them.
3. IT GRIPS with spring tension.
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motors. In view of the necessity of making these assumptions, it would be a waste of time to make a small correction to the percentage impedance, due to operating on a tap above or below the normal voltage. Even though such a correction were applied to the percentage impedance figure, it would make no noticeable difference in the calculated short-circuit current, and in practice is ignored.—S.O.H.

Measuring Power

QUESTION R21—Will someone please give a clear explanation of how to go about getting an accurate test and computation of the kilowatts in a 3 phase 3 wire balanced circuit with a single-phase hook-on type of kilowatt meter.—J.M.M.

ANSWER TO R-21—In measuring power in three phase three wire circuits, we should consider the wires as A B and C. Then with the hook-on ammeter in line A, and the voltage coil between A and B, measure the power. Repeat with the ammeter in C and the voltage coil between B and C. Add the two readings and that is the power in the circuit. In the case where the power factor of the three phase load is less than 50%, it is necessary to subtract the smaller from the larger reading.—H.H.S.

ANSWER TO R-21—For a balanced three phase, three or four wire circuit, connect the potential leads across any two phase wires. Clip the hook around the same two phase wires in such a manner that one wire enters the closed hook from the back side and leaves from the front side and the other wire enters the closed hook from the front side and leaves from the back side. In other words, the two phase wires cross inside the closed hook. Read the total kw consumption on the dial. Or, on a three phase, four wire circuit, connect one potential lead to the neutral. Connect the other potential lead to any phase wire. Clamp the hook around the same phase wire. Multiply the reading by three for total consumption.

Another method for a three phase, three wire circuit is to take two separate readings, as follows: Connect one potential lead to phase A and the other potential lead to phase B. Clamp the hook around phase B and take the reading. Next change the potential lead from phase B to phase C. Remove the hook from phase B to phase C. (Be sure that phase C passes through the hook in the same direction as phase B did). Take the second reading and add it to the first.

For a single phase, three wire circuit, two measurements should be taken, as follows: Connect one potential lead to the neutral. Connect the other potential lead to one phase wire. Clamp the hook around the same phase wire. Take the reading. Next shift the potential lead and hook from the first phase wire to the other phase wire. (Be sure that the second phase wire passes through the hook in the same direction as the first phase wire did.) Take a second reading and add it to the first for total consumption. If it was necessary to reverse the potential leads on the second measurement in order to get an upscale reading, then subtract the smaller reading from the larger instead of adding. If there is no load on the neutral, the potential leads may be placed across the two phase wires and the hook clamped around whichever phase wire that gives an upscale reading for total consumption.

To measure Vars on three phase, three or four wire circuits, connect the two potential leads across any two phase wires and clamp the hook around the other phase wire. Multiply the reading by 1.732.

On extremely low power circuits, the scale deflection can be increased by wrapping the wire around and through the hook two or more times. In such cases, it is necessary to divide the scale reading by the number of turns.

To determine the power factor, multiply the KW reading by 1000 and divide by the volts times the amperes.

In all the above measurements when single readings are taken, a downscale reading can be corrected to an upscale reading by reversal of the potential leads or by reversing the direction of the wire through the hook. But where two readings are needed, always pass the phase wires through the hook in the same direction for both readings and correct for upscale by reversing the potential leads.

—W.R.S.

Can you ANSWER these QUESTIONS?

QUESTION D22—We have a 1000 kva transformer bank, voltage 2400 to 440 volts. It is hooked delta-delta. We sometimes have trouble to locate grounds on this bank, so we would like to ground a point on the secondary winding to simplify things. Can someone tell me the best method to do this—one that will conform to the Code? What is the highest permissible voltage to ground on secondary circuits?—M.D.

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QUESTION E22—We have a 750 kva 4160 volt generator, 3 phase 60 cycle, 514 rpm, 4 wire (4160/2400V) driven by a diesel engine. The exciter is belt driven and the voltage regulator is of the usual resistance type, Silverstat. We desire to operate two 200 hp motors, a small amount of lights, and small motors of approximately 75 hp. The large motors are to operate air conditioning compressors and as such are subject to automatic starting. Reduced voltage starters have been considered but the instantaneous voltage dip of the generator before the voltage regulator can restore voltage will cause severe light flicker and possibly drop out the undervoltage devices on control equipment. We have heard of series capacitors being used to automatically compensate for the starting reactance of the motors and at the same time use full voltage starters for the controllers. Can someone tell us how to figure the rating of the capacitors needed, and any experience with such applications? Normal utilization voltage is 240 through a step-down transformer, however if desirable, the motors may be run directly off the 4160 volt generators. It is understood that the compressors can be unloaded during the starting period and that only one of the 200 hp motors will be required to start at a time but that after one has started the other may start.—L.R.B.

QUESTION F22—I'd like to know how to test the secondary current and voltage of a wound rotor induction motor. In this case the drum controller, (or dial type controller), and resistor bank are used for both starting, and speed regulating of the motor. With the motor running I tried using a G. E. type AK-1 hook-on voltmeter on the leads from the slip rings on the motor to the controller but got no readings on either the voltmeter or ammeter. Can someone tell me why there were no readings? Also how can I test the voltage or amperage through various speed selections of the drum controller?—A.R.

QUESTION G22—Why is insulating oil used in the top of a high voltage bushing?—E.S.H.

QUESTION H22—How can I test switches that overheat on their rated load before I install them?—H.S.

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YOUR ANSWERS BY NOVEMBER 15



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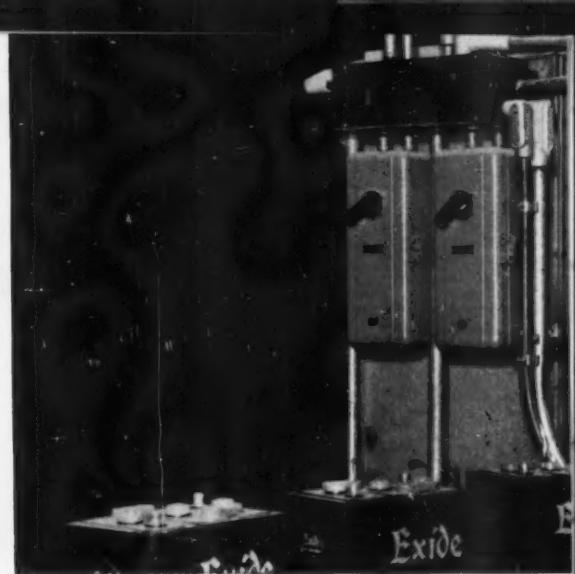
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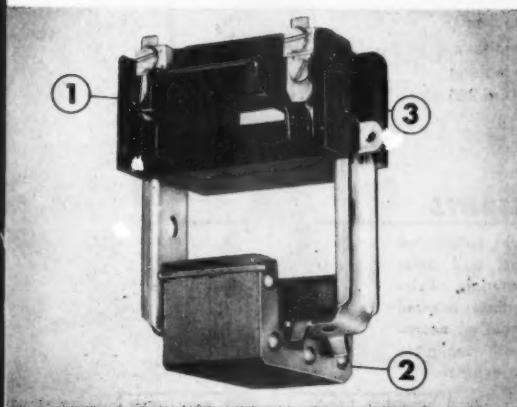
▲ **THE ELECTRIC STORAGE BATTERY CO.** of Philadelphia, Pa., makers of Exide Batteries, chose General Electric magnetic starters to protect production flow. They report no shutdowns due to starter failure. Above, two G-E fusible combination starters are used in key section of an Exide production line.



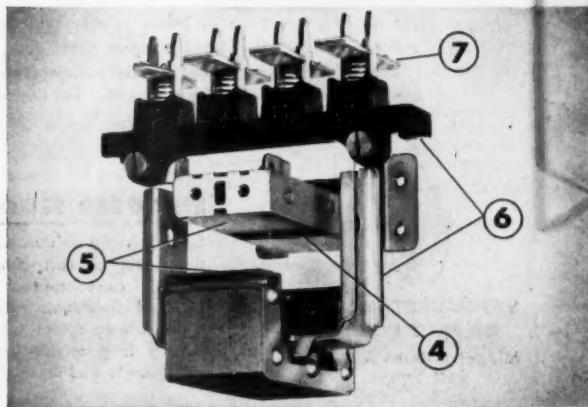
ELECTRO-LIFT, INC. of Bloomfield, N. J. makes motorized hoists which are subject to continual start-stop operation. They use G-E magnetic starters to assure unfailing operation to their customers, and to speed their own production. Ample wiring room and large pan-head screws, all in front, mean fast, easy installation.

industrial plants report:

Starters keep production up!"



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Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.

GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

B. Z. SEGALL, Consulting Electrical Engineer, New Orleans, La.

F. N. M. SQUIRES, New York Board of Fire Underwriters, New York, N. Y.

Carrying Capacity of Type USE Conductors

Q. I have been unable to find anywhere in the Code rules concerning the carrying capacity of Type USE conductors when individual conductors are buried in the earth. Can you advise me concerning this?—J.S.T.

A. At the present time the Code does not contain any specific reference to the carrying capacity of Type USE conductors where they are not contained in an approved cable, made up of two or more conductors. However, this will be changed in the next edition of the National Electrical Code as Table No. 1 will be revised to contain a heading "Direct Burial Carrying Capacity". While it is true that an individual Type USE conductor buried in moist earth will dissipate its heat much more readily than a similar conductor in conduit or cable, it is also true that those conductors are usually placed in conduit or metallic raceways where they enter or leave the earth; and when they are buried in earth, free of moisture, they often have as much difficulty dissipating heat as they would have within a metallic enclosure making it necessary that we give them carrying capacities shown in Table 1 and not those shown in Table 2, even though under ideal conditions it is possible they might be capable of carrying considerably more amperage than that given them under Table 1. Therefore, while the present Code edition does not provide for such carrying capacities, you should utilize the first column figures contained in Table 1, for determining the carrying capacities of Type USE conductors.—G. R.

Range Receptacles

Q. I have been using service cable for range outlets—the receptacle being installed on the floor, where the cable comes through the floor, and fastened to the mophoard.

The building inspector interprets

3364-2—that the service cable must run in conduit from the basement extending 6 inches above the floor and the range receptacle mounted above the conduit. I maintain that the rule applies only where the cable runs above the floor to a receptacle mounted on the wall.—F.W.P.

A. According to Section 3382, service entrance cable of the unarmored type shall be installed in accordance with the rules covering non-metallic sheathed cable. Section 3364-b covering mechanical injury therefore applies to unarmored service cable. If, as you say, the receptacle is mounted on the floor, it appears to me that this rule does not apply since it only covers exposed work and under the conditions stated there is no exposed service cable. It also follows, however, that the inspector may not be satisfied that a range receptacle mounted on the floor is designed to withstand the mechanical injury or the corrosion exposure which may be involved with such practice and he is using Section 3364-b as a means of satisfying this question of hazard. Section 3007 of the Code requires receptacles to be mounted in boxes which afford protection from mechanical injury. Section 3369 recognizes devices such as range receptacles of insulating material to be used without boxes. The inspector may feel that such devices should not be mounted on the floor especially where existing conditions indicate that they will be subject to mechanical abuse.—B.A.McD.

Cold Storage Vaults

Q. What type of wiring is required in cold storage vaults?—C.K.

A. There are various types of cold storage vaults. Some vaults are extremely dry and house materials such as furs and other materials which are non-corrosive. Other vaults are used to store salt, chemicals, foods and may be very damp and corrosive.

In a dry vault housing non-cor-

rosive materials I would say that any type of wiring would be approved. In a damp or wet vault with corrosive materials, some special wiring system would have to be installed.

The Code makes reference to cold storage warehouses in several sections. 3003 refers to the corrosive effects in salt storage and similar corrosive areas. Section 3015 calls attention to the problem of circulating air between warm and cold sections in cold storage plants.

Non-metallic sheathed cable (Romex, etc.) is definitely prohibited in cold storage warehouses, but I believe this refers to the type similar to those to be found in ice plants, breweries, etc.

Non-metallic waterproof wiring is permitted, by special permission, in cold storage plants.—B.Z.S.

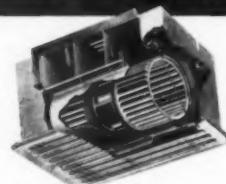
Grounding Conductor

Q. I have just received a rejection notice from the inspector on a dwelling and private garage because I did not extend the grounding conductor from the dwelling to the private garage. The wiring in this garage consists of armored cable supplying two light outlets and one convenience outlet. The circuit for the garage is taken from the distribution panel in the house where it is protected by a 15 ampere plug fuse and is then run underground using Type RR wire to the garage building. Does the Code require that I run a third conductor from this distribution panel to this garage building to ground the metal boxes and armored cable in the garage?—R. C. G.

A. Yes, the Code does require under Section 2531 that all exposed conductive materials enclosing electric conductor be grounded for the purpose of preventing a potential above ground on such enclosures. Therefore, if the garage in question contains any such exposed armored cable sheathed or metallic boxes or covers, the National Electrical Code will require that such exposed metal

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be grounded. Then under Section 2556, you will note that isolated sections of metallic raceway or cable armor, if required to be grounded, shall preferably be grounded by connecting to another grounded raceway or armor but may be grounded in accordance with Section 2557 where permission is granted to use a grounding conductor run with the circuit conductors or by a separate grounding conductor installed the same as a grounding conductor for conduit and the like, or as provided under Section 2524 which reads as follows: "If more than one building is served by the same service, the grounded circuit conductor of the wiring system of any building utilizing one branch circuit supplied from such a service may be connected to a grounding electrode at such building."

I also wish to call your attention to the misuse of the term "RR", as not all wires called RR by their manufacturer are approved for direct burial in the earth and, therefore, Code authorities desire that the term "USE" be utilized whenever one is referring to a type of conductor approved for direct earth burial.—G.R.

Feeders For Heaters

Q. In wiring six power outlets for use in an industrial plant, I ran 3 No. 6 wires from a 50 amp breaker to a distribution cabinet containing 14-20 amp. breakers. I used 3 No. 12 wires to each power outlet and installed two duplex receptacles using a common neutral with one receptacle on each side of the line, using 12 circuits for the six double

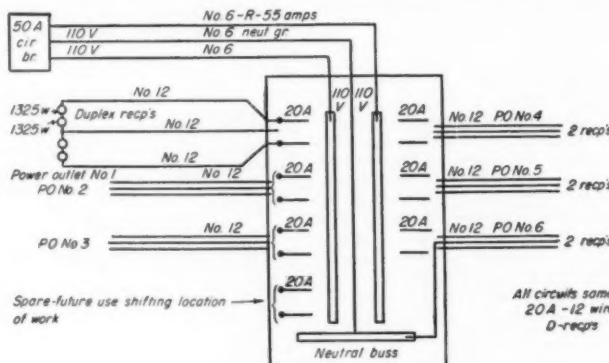
receptacle outlets which are for utility use of heating appliances which may be shifted from one location to the other.

The total equipment available is four 1325 watt devices, one 1000 watt device and two 300 watt devices. The plant management says he can see the possibility he may want to use up to two additional 1325 watt devices. All the equipment is 110 volt.

The intent of the two extra breakers was to be spares for some future outlet in case it is desirable to shift some of the present equipment to some other location. The intent of placing each duplex receptacle on a separate circuit was that in the use of equipment at that location, one wouldn't overload a circuit that might be supplying equipment at another location. Users of the equipment were told to always use outlets from both sides of the line to balance the load.

Inspection authorities say that I must run a minimum of No. 2 feeders with 100 amp protection due to the size and number of breakers in the distribution cabinet and because of the possibility of the use of all of the load on one side of the line. Is he right?—C.G.L.

A. A review of the question indicates to me that the Inspector has figured the feeder size on the basis of maximum use of the equipment and with six 1325 watt heaters connected to one side of the line. This condition represents, with the equipment provided for use, the maximum load to which the feeder may be subjected and it is my opinion that such pro-



Amount of equipment to be served

- 6—1325 Watt heaters=7950 Watts=72 Amps. at 110 V.
- 1—1000 Watt heater
- 2—300 Watt heaters
- Feeder loading maximum
- 6—1325 W. heaters on one side
- 72 Amps. total
- Circuit loading maximum
- With duplex receptacles
- 2—1325 W. heaters on one side
- 24 Amps. on 20 Amp. circuit
- and 20 Amp. receptacle

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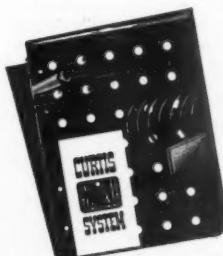


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LIGHT CONTROL

The lighting system* of this revolutionary new method is an extendible arrangement of channels carrying the control equipment and wiring. T-12, 96-inch, 72-W. slimline lamps are mounted like ladder rungs between and at right angles to the Curtistrip channels. This system is supplied completely wired with ballasts and lampholders. All metal parts are finished baked white "Fluracite" enamel.

*Listed by Underwriters' Laboratories, Inc.



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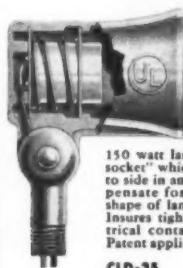
LS-3
150 watt lampholder
mounted on sturdy metal
spike for nailing to side of
building, post or concrete, or
inserting in ground. Complete
with 3' cord and plug.

LS-10
Same as above, with
10' cord and plug.



LC-2
150 watt bracket type lamp
holder complete with combi
nation cover for mounting
on 3" or 4" octagon
post or wall. Includes 20' of
portable cord with stripped
and tinned leads. Cover has
knockouts to fit box ear
centers and to allow cord to
enter box.

LC-5
Same as above, with 3' cord
and plug.



**CLD-150
LAMPHOLDER**

150 watt lampholder with "floating
socket" which moves forward or side
to side in an eccentric plane to com
pensate for variations in size and
shape of lamps, sockets or castings.
Insures tight seal and positive elec
trical contact. Completely wired.
Patent applied for.

CLD-35
Same as above for 300 and 500 watt
mogul base lamps.



CLD-150
CLD-150 "floating socket"
lampholder mounted on
PB-1/2 wall or pole bracket
having 2 porcelain insulating
tubes to protect leads.



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CLD-150 "floating socket"
lampholder mounted on a
CO-1 cover with 1/2" threaded
hub in center. Cover fits
3 1/4" round ceiling pans,
3 1/4" and 4" octagon boxes
and concrete boxes. Pro
vided with knockouts to
fit box ear centers and to
allow cord to enter box.



CLD-sp-150
CLD-150 "floating socket"
lampholder mounted on
sturdy metal spike, with
10' cord and plug.

CLD-sp-35
Same as above, with
CLD-35 "floating socket"
lampholder for 300 and 500
watt mogul base lamps.

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Write for Information and Prices

cedure is correct. I have made a sketch showing the conditions outlined in order to clarify the problem. Reference to the sketch shows the six power outlets, each consisting of two 20 ampere branch circuits obtained from a 3-wire, 110-220 volt circuit. The maximum loading of any branch circuit occurs when two 1325 watt heaters are connected to one duplex receptacle. This load uses 24 amperes. Since there are four 1325 watt heaters and the management indicates the need for two more, we should figure accordingly. The heaviest condition of loading of the feeder would occur when six 1325 watt heaters were connected to one side of the line. The loading in amperes would be 12 amps times six which equals 72 amps and requires a No. 2 Type R conductor. A No. 6, Type R conductor has a carrying capacity of 55 amps and if same was used under these conditions, it would be overloaded by 17 amps. The above computation does not include any provision for additional load on the extra 3 wire circuit since you say it is to be used only to serve the present equipment at possibly some other location in the plant. According to the foregoing a No. 2 feeder would be required and I believe the Inspector has been reasonable in his requirements and generously considered the factors involved with the specific load and the use of same.

According to your plan duplex receptacles are used which would permit, at any power outlet, two 1325 watt heaters to be connected to a 20 ampere 110 volt branch circuit thereby overloading same and also the receptacle. The same also applies if a 1325 watt and a 1000 watt heater were connected to the same duplex receptacle. I believe that this factor also deserves further consideration.

Irrespective of good supervision, such installations very often serve loads not intended or provided for. Another important consideration for heating loads is voltage drop in the feeder or circuit due to long runs or overloading since any deviation from the required voltage seriously affects the heating.

Irrespective of instructions for balancing the load, I personally do not believe that any design of a wiring system should place the responsibility for safe operation in the hands of the operators, especially where six stations are involved — B.A.McD.

Appliances

Q. An electric dishwasher with a heater and motor over $\frac{1}{2}$ hp is installed in a multi-family dwelling. This appliance is on a circuit of its

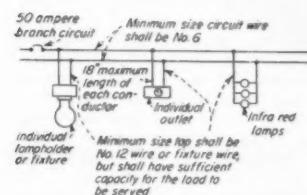
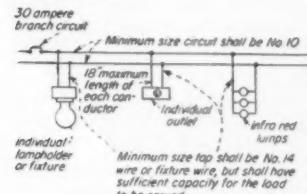
own. The motor only has a manual disconnect, both the motor and the heater are on a breaker at the panel, which is within the apartment. Does this Satisfy 4241-cl and 4241-e of the National Electrical Code for a disconnect means?—C.T.

A. In my opinion the installation as outlined does satisfy both code requirements.—B.Z.S.

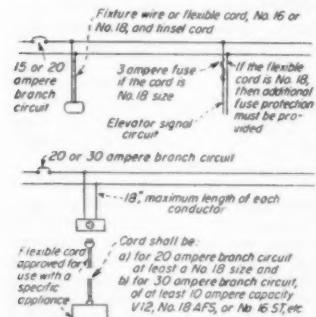
Taps and Fixture Wires and Cords

Q. Paragraphs 2 and 3 of Section 2121c seem to contradict each other. No. 12 and No. 14 seemingly are the minimum sizes of conductors permitted by paragraph 2, yet No. 16 and No. 18 flexible cords or fixture wires are permitted by paragraph 3. J.A.O'D.

A. The two following diagrams illustrate the requirements of paragraph 2.



Paragraph 3 provides for the use of conductors smaller than No 12 or No 14 if fixture wire and cords are installed under certain conditions.



These are illustrated in the following two diagrams.—B.Z.S.



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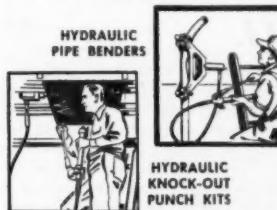
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Underground Conductors

Q. Where a building is served by an underground service, is it necessary that the underground conductors be run without splice to the service equipment or may they terminate in a junction box at their point of entry to a building and there be spliced to conventional building wires which are carried in a raceway to the service equipment?—M.F.P.

A. Where underground conductors enter a building, the Code provides under Section 2305 that they may terminate in a junction box or they can be spliced to conventional building wire which should be carried through a metallic raceway or an approved service entrance cable to the service equipment. This permission reads as follows: under Paragraph C: "A connection is permitted if properly enclosed, where an underground service conductor enters a building and is to be extended to the service equipment or meter in another form of approved service raceway or service cable." It should also be pointed out that under Section 2351 the service equipment must be located at a readily accessible point nearest to the entrance of the service conductors. The run between this junction box and the service equipment must be kept short unless a raceway is used which is imbedded within the masonry wall to a depth of at least 2 inches in which case no limit is placed on the length of run between this junction box and the service equipment.—G.R.

Cable Runs Continuous —(Continued)

Q. I like to read "Questions on the Code" in "Electrical Construction and Maintenance" but am so busy that I very seldom have the opportunity to ask questions or comment on them. However, in the July issue there is a question asked by E.J.N. and the answer by you. I wish to take you to task as I do not agree with you on the use or purpose of the junction box.

You answer in part to E.J.N. that a junction box could not be used along a basement wall for the purpose of taking off from that to receptacles (or other outlets) to the floor above. Now to all wiremen in general when it states that cables or wire must be continuous from outlet to outlet this certainly means a junction box as being an outlet. Now outlets in themselves do not mean just a ceiling outlet box for a lighting fixture. And in

your answer you imply just that. For instance in a window job where one must set a junction box close to the fixtures in order to change from building wire to asbestos wire or fixture wire from that to the fixture, that box would certainly be a "junction" and junctions for sure are not limited only to feeders or the like.

Carrying it further you state that switch boxes must not be used for junctions. That again depends on just how far you carry it. Please note the articles in the May issue Power & Light for Pittsburgh's Gateway Center. Note under the Mellon Office building article on page 73, center column, bottom it says, "Contrary to normal procedure lighting circuits in this building are pulled in the Q-floor cells with switch leg risers going up walls, etc". There necessarily the switch box becomes a junction because the wire to the fixture continues on through it to fixture.

It certainly will be most necessary for the Code officials to clarify this point and to show good reason why a junction cannot be used. The cost would easily be 25% more on any given job if one could never use a junction box in certain locations.

I think you should answer E. J. N. again because he does not know what to do now.—C.B.

A. I sincerely appreciate your letter since you give me an opportunity to further clarify the question and also my position in the matter. My reply to E.J.N. was based entirely on the Code rule involved, Section 3005, and I believe if you will study this rule you will find that my answer to the Code question is correct, irrespective of common practice all over the country. The rule in question reads: "Raceways and Cable Assemblies shall be continuous from outlet to outlet and from fitting to fitting."

The definition of an **Outlet** reads: "A point on the wiring system, at which current is taken to supply fixtures, lamps, heaters, motors and current-consuming equipment generally." According to this definition, a switch box or a junction box could not be considered an outlet.

The definition of **Fitting** also rules out the classification of a switchbox or a junction box as a **Fitting**.

As a result of this rule and the definitions, a cable run must be continuous from outlet to outlet and an outlet is a point for the attachment of current consuming devices which excludes switchboxes which contain control devices and junction boxes which are in no way concerned with current consuming devices. Section 3701 of the Code definitely distinguishes between a junction box and an outlet.

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guishes between an outlet box, a switch box and a junction box. I personally agree with your opinion that the intent of this rule is not to restrict cable or raceway wiring as I have outlined and it is common practice to do the things which I say violate this rule but I believe you will agree that the rule as now worded does not recognize such procedure and should be clarified. The details connected with the E.J.N. case involved a junction box, in an accessible attic, which was used on a branch circuit for feeding outlet boxes and switch boxes. The Inspector criticised the installation as a violation of Section 3005 and requested the removal of same and I maintain that he was correct irrespective of usual procedure. With a lawsuit in the background, with Lawyers and Judges who read rules and do not accept unofficial interpretations, I personally believe the decision of the Inspector would be upheld.

In order to correct or clarify this question, I believe the rule in question must be clarified and I am sending copies of all correspondence involved to the Electrical Committee NFPA for their consideration. If this matter receives favorable action and is clarified, in the Code, you have just reason to feel that you have made a substantial contribution towards Code improvement and the time and effort given was worthwhile.—B.A.McD.

Overcurrent Protection

Q. I would appreciate your clarification of the Code ruling concerning overcurrent protection for remote control circuits for motor operation. Recently I had occasion where I had to remove overcurrent protection which I had installed on a control circuit for a fire pump motor. This control circuit operated at 110 volts and the rating for the fuses supplying the motor feeders was far in excess of the 500% permitted under Section 2403 of the Code. Can you explain this? —A. J. S.

A. Section 2403 of the Code probably should carry a reference to Section 4372. As you will note under paragraph C in this section, the opening of the control circuit controlling a fire pump or similar types of equipment may create a hazard and, therefore, be undesirable, and for this reason Section 4372 states that where the use of overcurrent protective devices within the control circuit might create a hazard, they shall not be used. Then as you pointed out, they need not be used where the rating

or setting of the branch circuit overcurrent device is not more than 500% of the carrying capacity of the control circuit conductors provided that device is not one of the so-called "time lag fuses". We also want to call your attention to the fact that remote control circuits which may be classed as Class 2 circuits under sub-paragraphs a, b and c following Section 7281 of the Code, need have no overcurrent protective devices upon them regardless of the type of motor load they are controlling. Then under Section 4372 of the Code, you will find under paragraph B that if the control device and the point of control, that is the stop and start buttons, pressure switch, thermostatic switches, etc., are both located on the same machine and the control circuits do not extend beyond that machine, such control circuits need not have branch circuit overcurrent protective devices.—G. R.

Voltage Drop

Q. In connection with Section 2202 in which the voltage drop is given as 1% for lighting and 3% for power loads, at what temperature is this generally considered to be for? —H.S.F.

A. Voltage drop, considering the resistance factor only, can be found from the formula:

Circuit length in feet \times amperes \times resistance per foot of wire. The resistance is expressed by the equation

$$R = p l/A$$

where p is the resistivity (usually the volume resistivity), l is the length (one foot in this case) and A is the cross sectional area of the wire in question.

The value of p is usually expressed at a base temperature of 20°C . In table 1 of Chapter 10 the allowable currents are based on a room temperature of 30°C . In table 18 the values of resistance are for temperatures of 25°C . The temperature for any particular load condition will depend upon the ambient temperature and the wire temperature. Therefore, if we are attempting to obtain a highly accurate calculation of the voltage drop, all the factors involved must be corrected for the ultimate temperature.

In general, the resistance is obtained from some standard table and then corrected to the maximum allowable temperature for the particular cable. For example, a 500 mcm, Type RH wire has 0.0225 ohms per 1000 feet, D.C. resistance for tinned conductors at 25°C (Table 18). The ultimate temperature for Type RH

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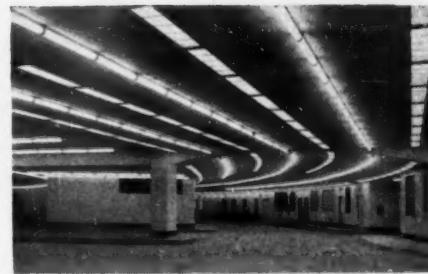


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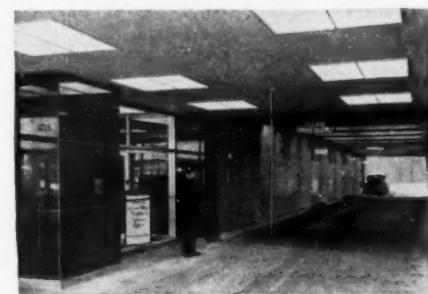


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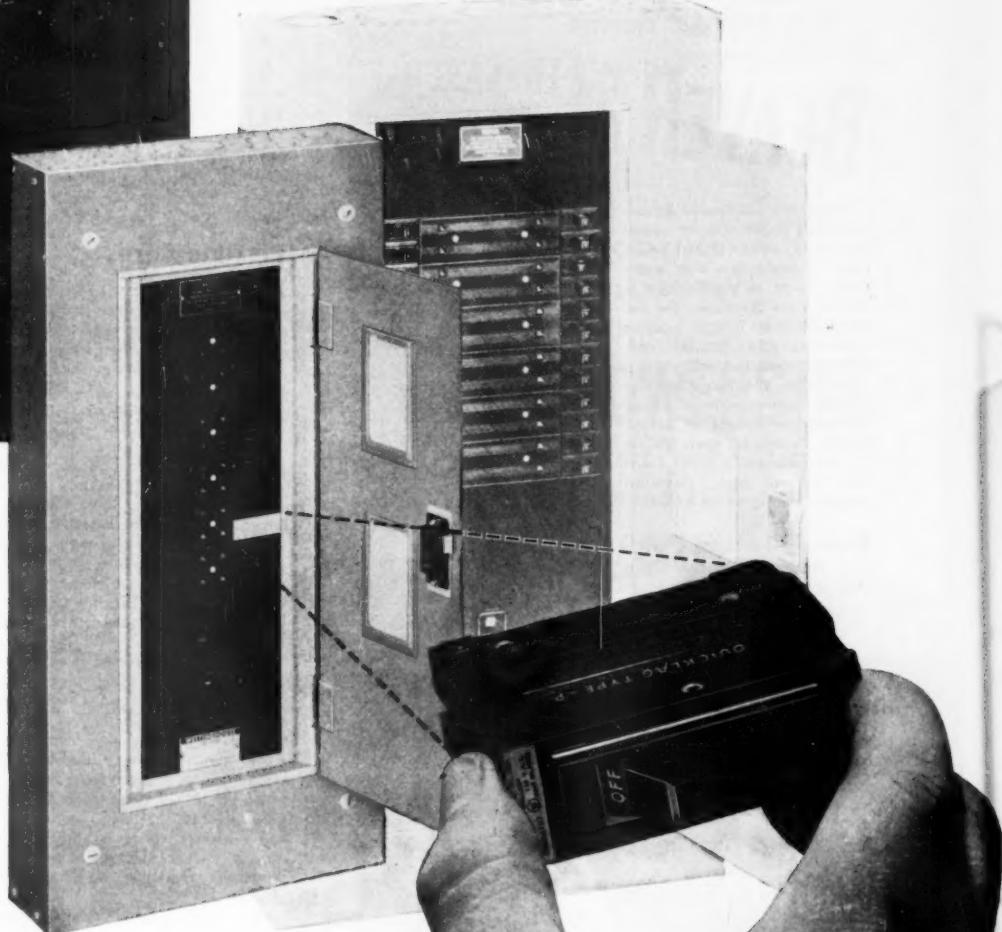
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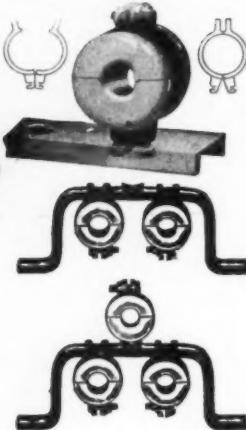


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insulation is 75°C. The resistance at this temperature would be

$$R_{75} = 0.0225[1 + .00385(75 - 25)] = .0269 \text{ ohms/1000 feet.}$$

For 60 cycle ac circuits the ratio of ac to dc resistance is 1.018 (Table 182). The value of .0269 would have to be increased by multiplying it by the 1.018 factor. The reactance would, of course, have to be considered to obtain the final value of voltage drop.

—B.Z.S.

Flexible Cords

Q. Where can we find in the Code book about drop cords? There was a fire inspector here and he said that they are not to be used in schools. We looked but could not find anywhere why they cannot be used. We have a high school, college and seminary.

—B.A.S.

A. Article 400 of the N. E. Code covers flexible cords for general use and Table 31 of Chapter 10 covers cord construction and the uses for which the various types are approved. Many cords are restricted to use in dry locations where not subject to "hard usage." Flexible cords used in hazardous locations is covered under Article 500.

A review of these rules reveals no Code requirement which prohibits the proper use of cords in a school, college or seminary. Section 4003 of the Code tells us where they may be used and where they shall not be used and there is no mention of the type of occupancy involved. Field experience, however, indicates that the main criticism of cords usually concerns their misuse, especially where the type of occupancy promotes exposure to mechanical abuse.

Since your question refers to Drop Cords, I believe you are particularly interested in a pendant hung from the ceiling with a lamp socket. If this assumption is correct, Article 410 covering fixtures is also involved. According to Section 4115, pendants shall not be installed in clothes closets, irrespective of occupancy and according to Section 4113 a lampholder on a cord shall not be installed over specially combustible material unless the restrictions are satisfied. Section 4146 and 4148 also concerns the use of flexible cords when used as pendants. While we are not familiar with the conditions involved with the Inspector's criticism, we are unable to comment. Insofar as the Code is concerned, flexible cord, used as a pendant, is recognized. If field experience shows that the nature of the occupancy promotes mechanical abuse to cords so used, the Inspector

has just cause to criticise such use. While it may not apply to your seminary, the students in some schools or colleges subject such pendant cords to considerable injury to the extent that they become a definite fire hazard.
—B.A.McD.

Wireways

Q. Is it permissible to install three 500 MCM Type RH conductors in a 4 inch by 4 inch wireway?—A.V.S.

A. Section 3623 permits 500 MCM as the maximum size of conductor to be installed in wireways.

Section 3624 places two further restrictions which are applicable in this case, viz.,

1. 30 conductors or less are permitted at any cross section of the wireway, except for
 - a. signal circuits, or
 - b. starting duty circuits for motor and starter control circuits,
2. 20% fill, maximum, except for splices and taps, shall not be exceeded at any cross section of the wireway for the sum of the cross-sectional areas of all conductors contained in the wireway.

The area of a 500 MCM Type RH conductor is 0.9834 sq. in. (Table 13, Chapter 10). The total area for the three conductors is

$3 \times 0.9834 = 2.9502$ square inches.

The minimum cross sectional area required for a 20% fill is

$2.9502/2 = 14.751$ square inches.

The area of a 4 inch by 4 inch wireway is 16 square inches. The above installation is permissible under Code rules.—B.Z.S.

Service Conductors

Q. We plan to wire a small plant on which the total load, after demand factor credits have been taken, will amount to 280 amperes. Our plans called for the use of a 400 ampere service switch and 350,000 circular mill Type RH conductor which has a carrying capacity rating of 310 amperes but when we applied for our permit, the local inspector told us we would have to use either 600,000 circular mill Type RH or we would have to multiple two sets of No. 3-0 Type RH conductor for this service. Is this really required by the Code?
—H. A. P.

A. Section 2304 of the Code states that service conductors shall have an adequate current carrying

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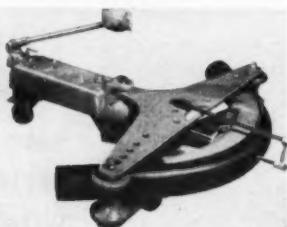
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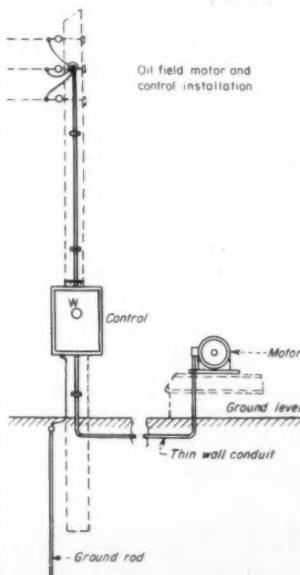
capacity to safely conduct the current for the load supplied without a temperature rise detrimental to the insulating covering of the conductors and shall have adequate mechanical strength. So in your case where the load to be supplied consists of 280 amperes, there is no question but what a conductor rated at 310 amperes would be ample. However, such an installation will provide little excess capacity and, therefore, if there is likelihood that additional capacity will be required within a reasonable length of time, it seems logical to attempt to sell the owner on the installation of a service having ample reserve capacity to handle any possible future loads.—G. R.

Tubing Used Underground

Q. In the "Questions on the Code" section of your May 1952 issue, I noted the second question, the application of Type RH wire for direct earth burial, with a great deal of interest.

My question is, "What do you think of using Type TW wire in thinwall conduit, buried 18 inches under the surface of the ground for a short run, as a permanent installation?"

This material is being used in oil well electrification installations between the motor control and the motor as shown in the accompanying sketch. We have made several hundred such installations in the past two years.



using thinwall conduit and Type TW wire, and have had no failures which could be traced to an insulation breakdown. Your comments on these conditions would be greatly appreciated.—C.B.T.

A. Sections 3482 and 3484 of the N. E. Code indicate that Electrical Metallic Tubing (Thinwall conduit) may be used for direct earth burial, provided approved conductors, such as Type TW, are used and provided the corrosive effect of cinder concrete or fill is safeguarded as outlined. If cinder fill is involved, the tubing must be buried at least 18 inches under the fill. We are assuming that couplings designed to prevent water from entering the raceway are used as covered by Section 3488. This wording, which is new in the 1951 Code, replaces the previous requirement which called for watertight couplings or connections. If the above conditions are satisfied, there is no Code violation and my favorable experience with such installations is similar to yours in the absence of failures which indicate otherwise.

While the above comments are general with respect to the use of tubing, we should also consider the type of insulation with respect to the occupancy. While I am not familiar with the application, we must remember that Type TW insulation is approved by U. L. for general use and wet locations. If the installation in question would involve oil seepage to the extent that oil might enter the tubing, we should then use a Type TW insulation which is approved by U. L. as oil resistant.—B.A.McD.

Grounding

STATEMENT: System or common grounding conductors shall be attached . . . on a cold water pipe of adequate current carrying capacity as near as practicable to the water service entrance to the building.

Q. Would the attachment of the system or common grounding conductor to an extension of the cold water pipe, within the building, i.e., in bathroom, to drinking fountain, toilets, etc., be a violation of this section, particularly when the cold water piping is available at the entrance to the building?—C.Y.

A. The above statement is taken from Section 2612a. It would be a Code violation if the attachment were made as outlined in the question above. The intent of the Code is to

- Conductor doesn't have to be centered for accuracy, (toroidal wound transformer)
- Pocket-size, belt-mounting
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\$39.50 complete with cowhide case
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AMPROBE "1200"
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Measures current instantly
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When you gamble on weak or defective insulation for motor and generator repairs, high labor costs will beat you every time. If you want to keep motors and generators in service longer and slash repair costs, then National's premium-quality insulation is a sure winner. Stop taking needless chances. Make National insulating materials a must for every motor repair job. They've been developed by National engineers for use in National's own shops. That's your guarantee of long life and consistent high quality.

National offers a complete line of standard insulation, stands ready to supply special shapes and other non-standard items to your specifications. Order from National — you'll get just the insulation you need and you'll get it fast.

make the system and/or common grounding conductor attachment on the water piping system at a point which is least likely to be disturbed, or otherwise subject this connection to any possible interference with its integrity as a definite grounding point.

Installing the attachment to any of the points within the building, as indicated, could at some time or other leave the system or equipment without any ground protection. For example, repairing or maintenance of the piping could at times require the ground to be disconnected from the water piping system within the building.

It should be remembered that Section 2581 states that "A metallic underground water piping system, either local or supplying a community, shall always be used as the grounding electrode where such a piping system is available." If the system is available anywhere on the property it must be used as the grounding electrode and the attachment must be made at a point where it will be, for all practical purposes "near to the water service entrance to the building." —B.Z.S.

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COLUMBUS 16, OHIO, U. S. A.

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On any application . . . controlling yard or remote building lights . . . operating motors, stokers, burners or other industrial equipment . . . the time switches you use must be reliable. That's why it's smart to use Paragon's built-in accuracy and reliability.

Available in a wide variety of types and models for all "ON and OFF" timed-switching operations — indoor or outdoor. Time switches . . . interval timers . . . 7-day program controls . . . cycle repeaters . . . time-delay relays and reset timers . . . there's a dependable Paragon Time Control to fit your needs. 300 Series from \$10.50 list.



Illustration shows Model 301 straight "ON and OFF" Time Switch for use where two or four operations per day are required. Self-starting, heavy-duty motor, available in 115 or 230 volt, SPST, SPDT and DPST models.

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WORLD'S LARGEST EXCLUSIVE MANUFACTURER
OF TIME CONTROLS FOR ALL USES

Electrical Workmanship

Q. I wish to comment on the reply of Mr. B. A. McDonald to the question of electrical workmanship appearing in the March 1952, issue, "Questions on the Code" section. Mr. McDonald, please refer to the 1951 N.E.C. introduction, paragraph 3, which I quote in part; "Compliance therewith and proper maintenance will result in an installation reasonably free from hazard but not necessarily efficient or convenient. This Code is to be regarded neither as a design specification nor an instruction manual for untrained persons." Mr. McDonald, your constitutional authority ends when you have made sure that the installation, inspected, is reasonably free from hazard. To go beyond this with demands trespasses the personal ownership prerogatives and lends itself to dictatorship.—A.R.H.

A. I cannot agree that the Code fundamental which you have quoted above intends, as you imply, to place the responsibility for an installation "free from hazard" entirely in the hands of an Inspector without due regard for all Code rules. Since the fundamental definitely tells us that compliance with the provisions of the Code will result in an installation reasonably free from hazard, I fail to see how the provision covering workmanship, Section 110, may be disregarded in attaining such an end. I am willing to agree, however, that any Code rule which is not justified of the

basis of hazard could be the subject of controversy and possibly difficult to enforce.

In support of my contention, with regard to "good workmanship", I find as far back as 1905, the Code provided as a suggestion the following: "In all wiring, special attention must be paid to the mechanical execution of the work. Careful and neat running etc. are specially conducive to security and efficiency and will be strongly insisted on." This recommendation continued in the Code up until 1937 when it became a mandatory Code provision. Since the fundamentals expressed in the Introduction of the Code are considered as satisfied, only when the rules which follow are enforced, it is evident that the Code believes it is necessary to install electrical equipment in a neat and workmanlike manner to attain an installation reasonably free from hazard. Otherwise these provisions conflict. The next question concerns the interpretation of "neat and workmanlike" and since the Code does not define or interpret this phrase, it is the responsibility of the authority enforcing the Code to make the necessary interpretation as authorized in the "Introduction" of the Code under "Enforcement and Interpretation." As a result, we have a rule, similar to many others, that the Inspector must interpret and apply in line with existing conditions and I believe the basis for your criticism rests on my interpretation of "good workmanship" and not on the violation of a principal. I contend that a service riser run at a 60° angle up the side of a building is neither neat nor workmanlike. Any electrician who has pride in his work and consideration for his client would agree.—B.A.McD.

Official N.E.C. Interpretations

INTERPRETATION NO. 386

(Issued July 22, 1952)

SECTION 4542—Transformer Vault Construction

Question: It is proposed to use in the walls and roofs of transformer vaults a fire resistant type of reinforced concrete not less than 6" thick. The extra fire resistance results from the substitution of an insulating material, known as perlite, for the usual sand and gravel aggregate so that the bearing strength of the resulting concrete will be approximately one-half that of standard concrete, but with approximately eight or nine times the heat insulating value. The bearing strength of this perlite concrete would be greater than that of the hollow tile or hollow concrete building units now mentioned in Section 4542. Would the use of such a material meet the intent of Section 4542?

Answer: Yes.



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Most inductive electrical equipment installed in a plant wastes money, money that can be saved. Some of it goes to supply non-productive magnetizing current. More of it goes to buy extra wiring, switches, and transformers to make up for this loss. Still more is wasted in reduced output through lost load. These wasted dollars can be saved by installing Sprague Power Factor Correction Capacitors at each piece of inductive electrical equipment. Write for free cost-saving guide, "Power Factor Correction" today.

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WHAT Life-Lines REALLY DELIVER IS MORE SERVICE...LESS SERVICING

The way to grease modern motors is DON'T!

The modern, *pre-lubricated* Life-Line consigned greased fittings to the motor museum almost ten years ago—and did away with faulty lubrication.

Think what it means. No more incorrectly greased motors. No failures from over lubrication, from under lubrication . . . from use of incorrect or dirty grease. Correct lubrication is sealed in . . . in advance.

Result? Longer motor life. Over a half million *pre-lubricated* Life-Line motors operating in every conceivable type of application have proved that outages from incorrect lubrication have been eliminated completely.

Take the case of an eastern manufacturer, for example. Motors were installed high on a press—out of reach of a maintenance man. Consequently, motor lubrication was forgotten. Bearings failed—windings burned. Then *pre-lubricated* Life-Lines were installed. Failures disappeared. Today, motors are still forgotten—but safely.

Remember, the way to lubricate a modern motor is don't. And, to spot a *truly* pre-lubricated motor, look for a motor that has *no* grease fittings. You'll *know* then it needs no greasing attention. You'll find your answer in Life-Lines.

Ask your nearby Westinghouse representative for a copy of "Facts on Pre-lubricated Bearings, B-4378", and for all the reasons why Life-Lines offer you more service on the job . . . less servicing. Or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-21682

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MOTORS and CONTROLS



IRVINGTON INSULATING VARNISH DIGEST



Comparative Tests Show Superiority Of Internal Curing

That heat-induced chemical polymerization results in more thorough drying of insulating varnishes and does away with soft, tacky interiors is indicated by studies performed on test lids with various types of varnishes. These studies show that varnishes which dry chiefly by oxidation may remain soft and tacky in the interior, even after prolonged baking, while the internal curing type of varnish, which dries by polymerization, sets throughout after only a few hours of baking.



Varnish on this test lid—one of a type drying by oxidation—baked two weeks at 220° F., remained soft and tacky in the interior



Internal curing varnish on this test lid set completely after only 8 hours baking at 212° F.

Air Drying Varnishes Have Many Applications

Air drying varnishes produced by Irvington Varnish & Insulator Company find wide use both as a final coat on windings already impregnated with other types of Irvington varnish and as a means of protecting other types of electrical apparatus and improving appearance.

These varnishes are also used as coatings on switch boxes, battery trays, conduit boxes, signal boxes and metallic surfaces in general. Varnishes are supplied in both black and clear types. A list of the major types is available on request.

[For further information, write the Sales Manager, Varnish Div., Irvington Varnish & Insulator Co., 18 Argyle Terrace, Irvington, N. J.]

"Deep-Cure" Insulating Varnishes Give Outstanding Performance

Finished Windings Combine High Dielectric, Mechanical Strength with Exceptional Resistance to Chemicals

Insulating varnishes that cure throughout by heat-induced chemical polymerization offer unusual service advantages, because this method of curing does away with wet, sticky interiors even in very deep windings. The exceptional degree of penetration of these varnishes and their complete solidification on curing combine to assure a thoroughly insulated, firmly bonded winding. These features prevent shorts caused by chafing of insulation resulting from the movement of adjacent turns.



Thorough impregnation and complete curing result from use of internal curing type varnish on these and many other types of windings

Finishing Enamels Protect Windings Against Oil, Dust

Insulated windings can be protected from the harmful effects of oil, moisture, chemicals, water and grease by means of a quick-drying coat of a finishing enamel. Formulated specifically for use as a finishing coat, Irvington Enamels are easily applied by brush and dry rapidly to a tough adherent film. Two major types are: No. 32 red, designed to give the fastest drying time consistent with good protection under most service conditions; and No. 30 red, for especially severe service conditions.



Easy to brush on, Irvington Red Enamels protect windings from corrosive action and also improve dielectric properties

In addition, these varnishes offer high dielectric strength, ranging from 1,700 to 2,200 volts per mil, depending on the particular type of varnish used. Specific formulations are adaptable to a wide range of operating conditions, from stationary coils to high-speed rotating equipment.

Chemical Stability

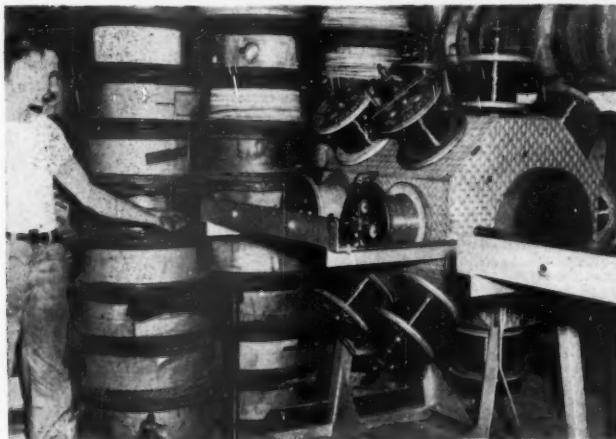
All Irvington internal curing varnishes have good-to-excellent resistance to oil, moisture, acids and heat, and the majority of them have good resistance to alkalies as well. Because of this high degree of chemical stability, they are adaptable to a wide range of service conditions. Typical applications include high-voltage coils; radio and TV transformers; low, medium and high speed armatures; field coils; oil-cooled transformers; relay coils.

Production Procedures

These varnishes are adaptable to a wide variety of application processes. The vacuum and pressure method is commonly used to assure the fullest degree of impregnation of deep windings. The varnishes may also be successfully applied by dipping. Brush application is used between layers as coils are being wound. All of these varnishes are adaptable to a variety of baking schedules. Their internal curing properties permit application of multiple coatings with only short, partial curing bakes between coats.

Internal curing varnishes are available in both black and clear types, and in formulations that provide either considerable flexibility or high rigidity in the finished windings. In addition, Irvington's Research Department is prepared to assist varnish users in evaluating the properties of varnishes for specific requirements of service performance, methods of application and baking schedules.

Motor Shops



WITH REELS ALIGNED behind guide holes in this threading bar, wire can be carried to winder in straight line.

Handicapped Veterans Aided by Special Equipment

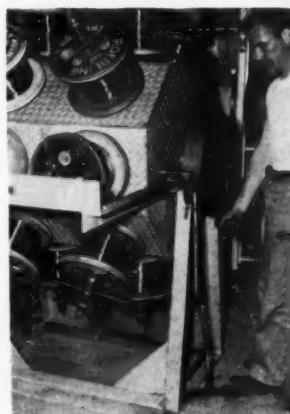
When Lockwood's motor repair shop in Trenton, N. J., recently employed several handicapped war veterans, many items of shop equipment were redesigned in order to facilitate operation with minimum effort.

Since most of the vets had been employed as winders and had to contend with several sizes of wire, a special de-reeler was constructed to hold eight different wire sizes. This has proved to be a sufficient assortment for most single-, two- and three-phase motors running from fractional to about 15-hp.

Eight sections of diamond-grid steel plate measuring 13-by-36-inches were welded together to form an octagon-shaped cylinder, and spindles were welded to each section about 8 inches in from each end. Spindles were threaded to engage Potter and Rayfield round wire de-reelers.

The octagon is supported by a bearing-cradled shaft on an angle iron framework, and an 8-to-1 ratio gear and crank makes the unit easy to rotate.

Holes drilled in the walls of the cylinder and a ratchet lock attached to the frame makes it possible to lock the octagon in place when the desired size of wire has been placed in front of the guide bar. A foot treadle releases the ratchet when further rotation becomes desirable.



OCTAGON REEL RACK is easily turned by means of geared crank and may be locked in any desired position by means of foot-controlled ratchet.

"Our veterans can operate the device with minimum effort," says George Lockwood, "because the machine is locked or released through foot pressure and the wheel is rotated easily by the high-ratio crank. Since the hole in the guide bar is already aligned with the winder, a straight lead becomes automatic. While the machine was primarily designed for our handicapped employees, we have found that they are generally advantageous for all our workers and we are making additional units."

Telescopic Hoist Furnishes Convenient Truck Lift

Raising motors and electrical equipment from loading platforms or sidewalks, and swinging them into the body of a light pick-up truck, is facilitated by a telescopic crane hoist devised by Al Schwindt, Buzzell Electric Company, San Francisco.

Little strain is placed on the chassis of the truck, for the lower section of the tubular mounting column passes



DISASSEMBLED, this sectional hoist consists of three parts that telescope into each other to form a convenient lifting agent. Lower section passes through pipe sleeve attached to truck body; transfers weight of load directly to ground rather than strain truck chassis.



ASSEMBLED, the unit permits a single man to handle a motor of considerable weight. When truck arrives at the Buzzell shop motor entrance, unloading is facilitated by an overhead crane that rides out over the sidewalk on a monorail beam (see right background).

Features With EARNING POWER!

WINDING HEAD Type J

- **Cam Release Mechanism**
Quick removal of coil groups. Instantaneous repositioning for further winding.
- **Adjustable**
Screw adjustment for winding fingers. Complete set-up in two minutes. Calibrated scales provided.
- **End Support Mechanism**
Slotted end support strips keep winding fingers parallel. Assures coil uniformity.

WINDING STAND Type F

Featuring a variable speed mechanism and a sensitive clutch and brake, the Type F Winding Stand is a rugged unit of welded steel construction. Large easy to read Productivity Counter. Convenient speed selection from 75 to 600 RPM. Adaptable for use with single phase heads or with tailstock attachments for small transformers, field coils, sole-nails or holding coils.

POTTER & RAYFIELD, INC.
Write for descriptive literature and prices.
P. O. Box 1042 • Atlanta, Ga.

Designed for small motor shops or departments, this P & R coil winding combination has real earning power. Reduces winding costs 50% or more. All elements are easy to adjust and operate. Forms coils for motors up to 40 HP and larger.



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ELECTRICITY
MUST NOT
FAIL!

ONAN Emergency Electric Plants Assure Light and Power!

POLICE RADIO TRANSMITTERS, fire department signal systems and many divisions of the civil defense corps rely on Onan Electric Plants for emergency electricity. When power fails, Onan plants start automatically, supply current for all essential uses, stop when power is restored.

Onan Electric Plants are an important part of a city's defense against disasters of many kinds. Write for folder!



A SIZE FOR EVERY NEED
GASOLINE-DRIVEN—Air-cooled:
1,000 to 3,500 watts A.C. Water-
cooled: 5,000 to 35,000 watts A.C.



D. W. ONAN & SONS INC.

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through the floor of the truck body and rests directly on the street or ground. A pipe sleeve secured to the body serves to keep the column from shifting laterally, and, when the truck is over soft earth, a steel sole plate prevents the column from sinking into the ground.

The crane framework is simply constructed of large-diameter conduit, with short stubs of smaller tubing serving as stiffening members when the sections are assembled. The top section is fitted with a horizontal inverted-tee, braced by a length of bar stock which is welded to the horizontal beam and the vertical pipe section. Sections are quickly assembled, a chain hoist is attached to the outboard end of the crane arm and the pick-up crew is ready for the lifting operation.

This readily-assembled, light-weight hoist makes it possible for one man to handle a motor of considerable weight, and he does so without undue strain to either himself or the truck chassis.

Special Cart For Armatures

Specially constructed armature carts are being used at Albertson & Son, Philadelphia, in moving armatures from one department to another for necessary operations. These carts are made of wood and save a lot of time and effort, and avoid handling armatures manually.

The wooden carts are 33 inches high, and 17 inches by 17 inches. They are constructed of four main legs and



SPECIAL CART is mounted on four casters and holds several armatures of varying sizes in vertical position for transporting from one department to another.

— for
every
wiring
need!

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TAPES

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Features the best of material carefully fabricated to provide maximum mechanical protection. Available in Standard and A.S.T.M. grades.

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Offers high elasticity, high dielectric strength and super aging qualities. Made in both Standard grade and A.S.T.M. — A.A.R. Specification

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Thin caliper plus a combination of good mechanical and dielectric strengths. Recommended for use wherever plastic tape is practical.

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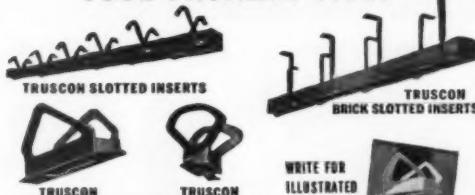


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...the electrical contractor's answer
to the problem of:

- anchoring . . .** motors, blowers, transformers, etc. to ceilings, walls and columns.
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- suspending . . .** lighting fixtures from ceilings, walls or columns.
- carrying . . .** auxiliary framing which supports the various cables, wires and other instruments in telephone systems.

FOUR DIFFERENT TYPES



Truscon Pressed Steel Inserts are placed in the correct, desired position BEFORE the concrete is poured. Saves time, labor, money. Easy and correct placement of fixtures and easy, quick changes.

TRUSCON STEEL COMPANY

1129 Albert Street, Youngstown, Ohio • Subsidiary of Republic Steel Corporation

made like a table. The top of the cart is a piece of five-ply plywood, that has holes of varying dimensions in it. The shafts of armatures are put into these holes so that they remain vertically in place.

A caster has been attached to the bottom of each of the four table legs so that it is movable. These carts can hold over 30 armatures if necessary, and because of the narrow width and depth, they are not in the way and are easily pushed to whatever department wants to use them for holding armatures.



ICE TONGS are used by Milton Eisenhardt to hold stator being lowered into tank.

Many Shop Uses For Ice Tongs

There are many uses for a pair of ice tongs in a motor repair shop. One such use is to hold stators while being dipped in varnish for baking. Such use goes on at Milton Eisenhardt's motor repair shop, Camden, N. J.

"Instead of taking time to wind rope around a stator, we just grip it with a pair of 35 cent ice tongs and let the hoist hook hold the handle of the tongs," says Mr. Eisenhardt. "Then we can use the hoist to bring the dipped stator to the oven, where it slides in for baking."

Tongs are used to hang stators for storage rather than leave them on benches, where they may suffer damage to the lamination or being knocked off center.

They are also used by employees in the general movement of stators around the shop. Rather than lifting by hand and sometimes having them slip out, a pair of ice tongs holds them secure. By holding a stator with a pair of ice tongs, the employee can have one hand free, as the tongs can be held with one hand, as the weight of the stator on the tongs makes the clamp that much tighter.

Growler Detects Shorts

A growler, constructed by Albertson & Son, Philadelphia, is used to check armatures to determine whether they

Save Time - Cut Costs



with the
OSTER
"Tom Thumb"
PORTABLE PIPE THREADER

● Note some of the jobs this No. 582 "TOM THUMB" machine can do for you: Ream, thread and cut-off in one 50-minute hour: 78 pieces of $\frac{1}{2}$ " pipe; or 64 pieces of 1" pipe; or 50 pieces of 2" pipe. Also, without using a nipple chuck, you can thread both ends of nipples as short as $3\frac{1}{2}$ " in the 2" size.

The Oster No. 582 "TOM THUMB" is the most advanced portable pipe threading machine you can buy. It's a real time and cost saver for your business!

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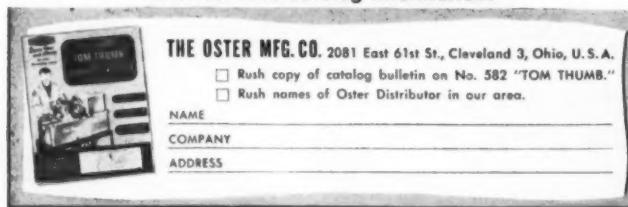
THE OSTER MFG. CO. 2081 East 61st St., Cleveland 3, Ohio, U.S.A.

- Rush copy of catalog bulletin on No. 582 "TOM THUMB."
- Rush names of Oster Distributor in our area.

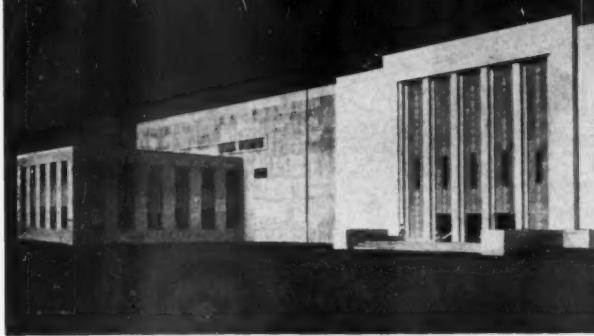
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Drive-It was used extensively by the electrical contractor on the new courthouse at Tampa, Fla. Conduit, panels, boxes and light fixtures all were quickly and economically fastened to concrete with Drive-It "300". For fast, sure anchorages to concrete or steel use Drive-It, the powder operated fastening tool.

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Drive-It uses a small powder load to drive hardened steel pins into concrete or steel. No power lines! No drilling!



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DRIVE-IT cannot be discharged accidentally due to the push and turn sequence. This, plus the large safety pad makes **DRIVE-IT** triple safe.



Exclusive Automatic Barrel Extension for fastenings inside junction boxes or other recesses.



DRIVE-IT is the only powder-actuated tool which requires but one standard power load regardless of penetration desired.



Exclusive Swivel Safety Pad easily rotated for getting into close quarter work.



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Canada: Ammo Power Tool Co., Ltd.
735 Broadway, Vancouver, B. C.

Please send FREE catalogue and literature.
 I want a FREE demonstration of **DRIVE-IT**.

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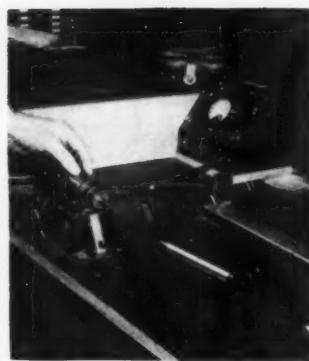
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THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO • OFFICES IN PRINCIPAL CITIES



GROWLER is used by Albertson & Son, Philadelphia, to check armatures for shorts before dismantling.

are good or bad before tearing down the entire armature. The growler is used to check the armature for a short, and if this preliminary test doesn't indicate a short, then a more exacting test is undertaken. This growler however, has saved many needless dismantling hours.

The growler is a transformer with an open iron attachment. The growler acts as a primary and the armature is laid across the open irons. The primary then induces a current in the armature coils. The armature closes the circuit.

A feeler is placed on the armature while it is being rotated in the growler. If the armature is shorted, the feeler begins to vibrate and jump around. If there are no shorts, the feeler just passes over the armature smoothly.

"We have constructed three such growers," says Al Albertson, "one having a million lines of force per square inch, another having 860,000 lines of force per square inch and a third having 500,000 lines of force per square inch. These sizes are used for testing armatures of different sizes."

For Dependable, High-Pressure Connections

BLACKBURN
Hi-Strength
CONNECTORS



High-pressure connections are the best electrical connections. They are also the best mechanical connections because tests show that they have better ability to stay tight — are trouble-free once installed.

All connectors in the famous BLACKBURN Hi-Strength Line produce high pressure connections. Also, they are priced right to give you low cost connections that you can depend upon . . . Be sure to specify BLACKBURN!

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Infra-Red Oven for Portable Use

A shop-built, portable infra-red oven is now filling two important needs for the Fleck Electric Motor Repair Service, Norristown, Pa. Primarily it serves as an oven which is easily transported on a small truck for motor repair jobs done on the customers' premises. In addition, it is an excellent spare oven for use in the shop when the regular oven is in constant use, or when doing small or other work which requires only a short baking time.

The oven housing is constructed on



Equity Savings & Loan Company, Cleveland, Ohio. The main office and three private offices are lighted by Wakefield Ceilings incorporating PLEXIGLAS diffusing panels. Architects: Deiter-Dolton Associates, Cleveland. Installed by Parker Electric Company, Cleveland. Wakefield Ceilings are produced by The F. W. Wakefield Brass Company, Vermilion, Ohio.

Lighting . . . Air Diffusion . . . Sound Control . . . Combined in a Luminous Ceiling

The Wakefield Ceiling shown above, with its corrugated PLEXIGLAS diffusing panels, combines three functions in a single installation.

- Mounted wall to wall beneath fluorescent tubes, the acrylic plastic panels provide high level, low brightness, evenly diffused illumination.
- Conditioned air from the space above the luminous ceiling is delivered into the room through the openings at the edges of the corrugated diffusers. The multiple openings insure an even distribution of air, with elimination of drafts on customers and employees.

- The simple framework for the PLEXIGLAS also supports acoustical baffles which absorb sounds from the work area.

This Wakefield method of combining air diffusion and sound control with the *best* in lighting—using PLEXIGLAS acrylic plastic—can reduce building construction and operation costs. In addition there is the advantage of duct-free, fixture-free appearance.

We will be glad to send you details about the installation shown above, and tell you how PLEXIGLAS may solve *your* lighting problem.

Canadian Distributor: Crystal Glass & Plastics, Ltd., 130 Queen's Quay at Jarvis Street, Toronto, Ontario, Canada.

PLEXIGLAS is a trademark, Reg. U. S. Pat. Off and other principal countries in the Western Hemisphere.

CHEMICALS  FOR INDUSTRY

**ROHM & HAAS
COMPANY**

WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Representatives in principal foreign countries



HERE'S WHY

You can THREAD and CUT Conduit Faster with a QUIJADA CHIEF

No wrestling with stubborn chucks. No wrenches. Exclusive Automatic Chuck operates at the flip of a switch. Four jaws front and rear instantly grip, center and turn conduit or pipe. Reams while threading. Equipped with wheel-type cutter. Weighing only 160 lbs. the Chief is perfect for in the shop or on the job use.

Check these times against your present methods.

Pipe Size	$\frac{1}{2}$ "	1"	$1\frac{1}{2}$ "	2"
Chucking Time	None - Automatic Chuck			
Threading Time	11 sec.	14 sec.	15 sec.	18 sec.
Reaming Time	None - You Ream While You Thread			
Cutting Time	5 sec.	6 sec.	7 sec.	8 sec.



HERE'S WHY

For Cutting Only - your Best Buy is a Portable E-Z CUTTER

Exclusive Power Driven Rollers revolve conduit or pipe for constant cutting. No slipping. Thousands of cuts per sharpening. Convenient foot switch frees operator's hands - speeds cutting! $\frac{3}{8}$ " to 2" range eliminates time lost in size changes. One lightweight E-Z Cutter handles all your cutting requirements anywhere.

CUTTING SPEED

Pipe	$\frac{3}{8}$ " 2 sec.	1" 4 sec.	$1\frac{1}{2}$ " 8 sec.	2" 10 sec.
Tubing	$\frac{3}{8}$ " 1/2 sec.	1" 2 sec.	2" 4 sec.	3" 6 sec.

SEE YOUR JOBBER OR WRITE FOR NEW CATALOG EC-10

QUIJADA TOOL

DIVISION OF GAINES-COLLINS 5474 Alhambra Ave., Los Angeles 32, Calif.
Manufacturers of Automatic Threaders & Cutters for More than a Quarter Century.

Quick and Easy to Install

G-E Standard Meter Sockets

- With quick-hitch sealing ring
- For all applications
- Corrosion resistant; long life

Contact your nearest G-E sales office.
General Electric Co., Schenectady, N.Y.



GENERAL ELECTRIC



INFRA-RED OVEN for portable use consists of sheet steel housing with reflector type infra-red lamps mounted around the inside of its base; can be used for small jobs on the customers' premises or as a shop-spare.

sheet steel. At its base, the housing measures three feet long by two feet wide, tapering to about half this length and width at the top. From its base to its top, the unit is three feet deep. The truncated pyramid construction tends to concentrate the heat.

Heat is developed within the housing by eight infra-red reflector lamps which are mounted around the inside and close to the base of the housing. The lamps are wired in parallel to a power cord which can be plugged into a wall receptacle.

Advantages of the electric heating unit are that it provides fast, clean, odorless, concentrated heat without the dangers of an open flame.



TO REDUCE HEAT AND FUMES in the shop and to improve ventilation, Charles Buckley of Atlantic City, N. J., makes extensive use of fan-served and lighted exhaust hoods over all his working areas. Hood dimensions correspond closely with working areas so that by-products of burning, roasting, welding or spraying are quickly removed from the air. Light switches are conveniently located on the front lips of hoods.

Wagner
ELECTRIC MOTORS
...the choice of leaders
in industry



Wagner

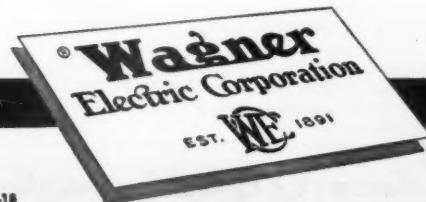
**Cast Iron Frame
MOTORS**

**Totally-enclosed
Fan-cooled**

Built for use in corrosive atmospheres

Wagner Cast Iron Frame Motors are designed to provide the corrosion resistance demanded by applications in chemical plants or in other applications where protection against corrosion is required. They feature completely protected laminations . . . special varnish treated windings . . . a cast iron, gasket-sealed conduit box . . . a running shaft seal . . . and are totally-enclosed and fan-cooled for complete protection against acids and alkalies present in the atmosphere in the form of dust, fumes or moisture. The photo at right illustrates the rugged, one piece cast iron frame, showing openings for ventilation.

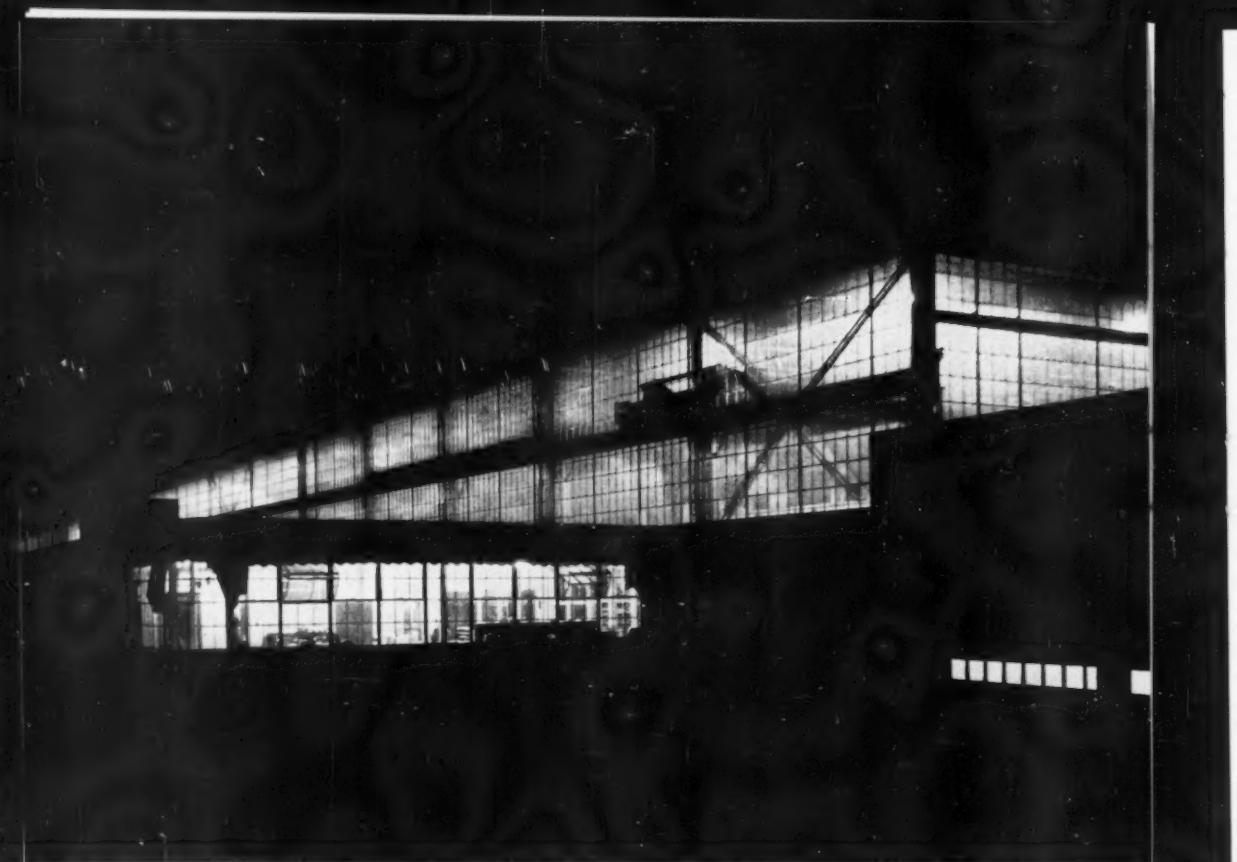
Where additional protection against explosive atmospheres is desired, an explosion-proof design (type JP) is available. Both the standard (type EP) and the explosion-proof types are built in ratings from 2 to 250 hp., with either normal or high torque characteristics. Non-ventilated 1 and 1½ hp. motors also available. Wagner Bulletin MU-132 gives complete information on these corrosion-resistant motors. Write for your copy today.



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ELECTRIC MOTORS - TRANSFORMERS - INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS - AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES



While the city sleeps . . .

Leader LIGHTING
FOR INDUSTRY



NEW Diffuser Unit—Designed to modify the contrast between lighted work areas and upper dark areas. 7% indirect lighting component. All-steel construction. For 2 or 3 40-watt lamps, in open or closed end models. Porcelain reflector if desired.



Other Leader industrial units are available in open and closed end styles, for 2 or 3 40-watt, 2 85-watt, for 2, 3 or 4 slimline lamps. Rugged construction, many convenient features, choice of models. Write for complete information. No obligation.



• . . . industry hums, with the production of vital defense materiel, the manufacture of more and better products to meet America's expanding needs. Lighting plays an indispensable part in maintaining production at continuously high levels . . . and Leader plays an important role in providing proper lighting for industrial production. The Leader line includes fixtures for all general and many specialized industrial requirements . . . and all units afford top performance, ease and flexibility of installation, economy in first cost and maintenance.

Sold and installed by the better
electrical wholesalers and contractors

Leader America's No. 1 Lighting Equipment Manufacturer

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Leader Electric—Western: 800 One Hundredth Avenue, Oakland 3, California
Campbell-Leader, Ltd.—Brantford, Ontario, Canada

Modern Lighting



CUSTOM FIXTURES complement interior appearance in this traditional-style grill-room. Each fixture uses one standard 1F 200-watt incandescent lamp.

Custom Fixtures In Rustic Grill

Lighting as a complement of interior style is the key to a successful incandescent installation in well-known Gallagher's Steak House, New York, N. Y. Here, custom design of the basic fixture-type has created a lighting system which conforms to the rustic richness and comfort of the furnishings and appointments of a traditional style grill-room.

Although adequate lighting intensity and lighting quality were important considerations in this installation, neither was a serious design problem. Achieving visual ease and comfort in a dining area requires only 10 maintained footcandles—the recommended level. It was quickly obvious, however, that a serious problem existed in the selection of the basic fixtures appearance which would blend with the thorough and expensive atmosphere in this interior.

A highly satisfactory solution was found in an indirect-type incandescent fixture which was custom designed to order for this installation by Gruber Lighting, fixture designers and manufacturers of Brooklyn, N. Y. This fixture uses one inside-frosted 200-watt incandescent lamp, mounted in an inverted sheet-copper cone reflector. The inverted cone is bolted through its apex to the intersection of two specially-treated crossed logs. The cone-

and-logs assembly is suspended by four chain hangers from a shallow cylinder ceiling mount to the four log ends.

Throughout the interior, 26 of these custom units are ceiling mounted on varying centers to conform to the irregular ceiling sections. In addition to their distinct decorative contribution, the units afford a lighting result which combines adequate intensity, absence of any direct glare and a bold pattern of brightness contrast which enhances the interior appearance.

Light and Glass Boost Small Store Eye Appeal

Brussels Mens Wear shop in San Diego illustrates the possibilities of creating an illusion of size in an unusually small shop. The treatment in this case consists of an all-glass front, in effect turning the entire shop into an attractive showcase, and an all-luminous ceiling, providing uniform high-level illumination for pedestrian attraction, merchandise appraisal and sales promotion.

The eggcrate-louvered ceiling has a 40-degree cutoff, with cells measuring 1½-by-1½-by-1-inches. Slimline 2-lamp 8-foot units are mounted as close as physically possible over the window areas flanking the recessed entrance way, resulting in an ultra-high level of 200 footcandles, while the same slim-



200 FOOTCANDLES highlight the display areas of Brussels Men's Wear in San Diego. Slimline lamps, spaced side by side for lumen concentration, are shielded by wall-to-wall cellular ceiling.

line units are spaced on 12-inch centers over the lobby area to provide a 90-fc level to this central section.

Two continuous rows of 8-foot T8 slimline fixtures, shielded by eggcrate bottoms, are surface-mounted on the 16-foot interior ceiling to maintain the general high level of illumination for appraisal and sales.

Remodeling a Bank with Light Alone

A new fluorescent lighting installation has created a vastly improved visual environment in the Farmers National Bank, Pittsburgh, Pa. In this installation, custom design of the basic fixture type has enriched the architectural interest of the complete interior, tripled the footcandle level and reduced the lighting load.

Prior to this new installation, the bank interior was lighted by hanging bronze fixtures, installed in 1909. Although an excellent installation in its day, the old system had become completely inadequate by present day lighting standards. With an original lighting load of 3.8 watts per sq. ft., the lighting level was a low and spotty 8-footcandles average. In addition, architectural appeal was lost, and the interior was somber.

Design for the relighting was not extensive but was thorough. Special fluorescent fixtures, custom designed by The Frink Corporation of Long

HOW G-E FLUORESCENT ADVANCES

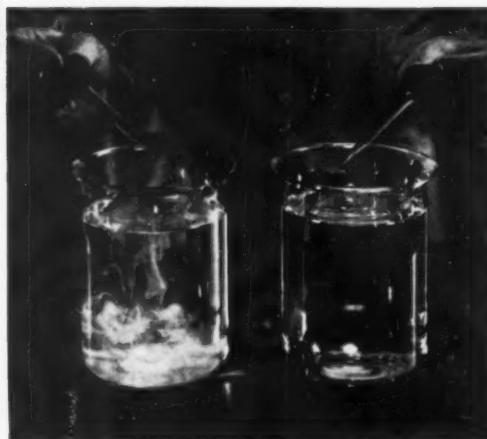


NEW RAPID START LAMP NEEDS NO STARTER, CUTS MAINTENANCE

Latest development of General Electric lamp research is the revolutionary new G-E 40-watt *Rapid Start* fluorescent lamp. Combined with General Electric's new *Rapid Start* ballast, it eliminates the starter required in standard

lamps to preheat the cathode. This gives almost instant starting, makes for smooth, simple operation. Maintenance is easier, more economical. And the cost of light is as low as standard preheat lamps.

General Electric *Rapid Start* lamps are rapidly becoming available. Many leading fluorescent lighting fixture manufacturers are incorporating the new lamps and ballasts in their latest equipment.



Water Too Pure To Drink Helps Give You More Light

**G-E uses special water to make phosphors,
wash lamp tubes**

Drop a chemical reagent in the water on the left and it clouds up from mineral impurities. It's ordinary tap water, safe enough for drinking—but not for G-E fluorescent lamps. These impurities would cut light output if they got into the phosphor coating, would create a streaked look on the glass tube.

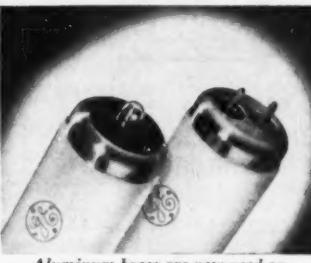
The water on the right is what General Electric uses in making their phosphors and to wash their lamp tubes. It's so pure it's tasteless because it's specially demineralized—twice as free of minerals as distilled water. It's a small precaution but it helps give you more light and better looking lamps.

GIVE YOU THE BEST LAMP VALUE

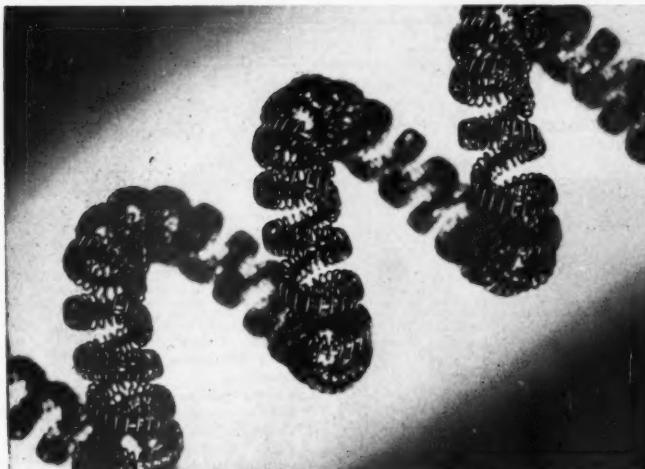
New Bases Help Insure Full Lamp Life

General Electric's new aluminum bases eliminate one reason why fluorescent lamps sometimes fail before they should. Aluminum won't crack from rough handling. The bases can be heated hot enough to make a tighter seal with the tube. Yet cold can't shrink them enough to make them crack the tube.

It took five years of General Electric lamp research to find a way to adapt aluminum for this use. It's one of many basic differences you get with General Electric fluorescent lamps.



Aluminum bases are now used on both single and bi-pin General Electric fluorescent lamps.



General Electric triple coil tungsten cathode is one reason G-E lamps last longer.

Extra coil gives extra light from G-E Slimline Lamps

In most fluorescent lamps, the starting chemical is deposited on a tungsten wire that's twisted into a double coil to hold as much of the chemical as possible as long as possible. This chemical helps start the flow of electrons that brings you light. When the chemical is finally exhausted, the lamp goes out.

A new General Electric technique coils the coil again—to make a triple coil. This triple coil holds more of the starting chemical, holds it more securely. It's now used in G-E slimline and other General Electric instant-start lamps. You get extra light for your money because your lamps last longer.

New Improvements Give You More For Your Lighting Dollar

When you use General Electric fluorescent lamps in your commercial and industrial installations, you can be sure you're getting the best lamp value. You get all the benefits of General Electric's famous lamp research and you get them first—gains in light output, longer-lasting lamps and new types of lamps.

A few of these General Electric fluorescent lamp developments are shown at left—the revolutionary General Electric *Rapid Start* lamp, use of specially demineralized water, the aluminum base and the triple coil cathode.

Other recent achievements include: an improved "T" phosphor with better light-giving properties, improved phosphor manufacturing methods and uniform end-to-end control for an even phosphor coating to give maximum efficiency.

Proof that these research advances pay off is the fact that light output of General Electric fluorescent lamps has climbed 17% since 1945! Under average conditions, current and maintenance account for about 90% of your lighting cost, the fluorescent lamp itself accounts for only 10%. That means General Electric's gain in light output is worth more to you than if you got your lamps free!

Be sure you and your customers get the best value in lamps... always specify General Electric!

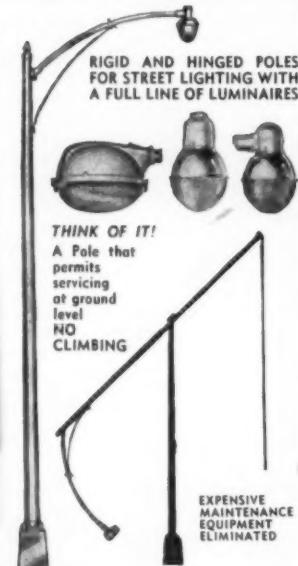
GET MORE COMPLETE INFORMATION TODAY

To learn more about General Electric's recent fluorescent developments, call your nearest General Electric lamp supplier. He'll be glad to help you solve your lighting problems, too! Or write General Electric, Div. 166-EC-10, Nela Park, Cleveland 12, Ohio.

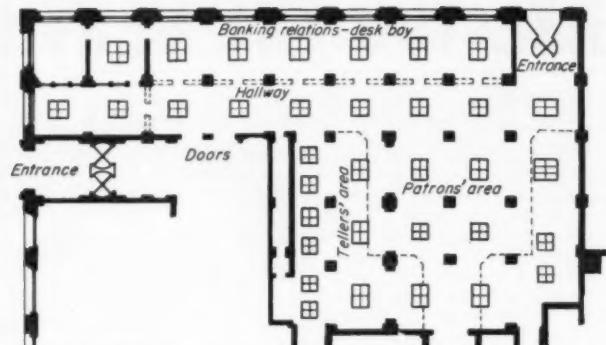
GENERAL  ELECTRIC

Give
YOUR CUSTOMERS
THE Quality
THEY EXPECT...
Install
Revere
ELECTRIC MFG. CO., CHICAGO 40
EQUIPMENT

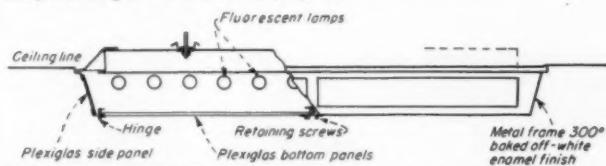
Wide choice of Units for
STREET—AIRPORT—SPORTS
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and OUTDOOR THEATER LIGHTING



REVERE ELECTRIC MFG. CO.
6017 BROADWAY • CHICAGO 40, ILL.
LIGHTING EQUIPMENT FOR EVERY NEED



Fixture Layout shows the disposition of the 34 fluorescent units. Two sizes of the basic fixture type were used to accommodate varying ceiling sections and the partitioning of the vertical marble pillars.



SEMI-RECESSED ASSEMBLY was the basic fixture style. Construction of the unit is shown above in relation to the ceiling line.



CUSTOM FIXTURES in this bank interior effectively remodels the interior with light alone; complements architectural style and provides a vastly improved environment over the original incandescent lighting system.

Island City, N. Y., were installed in place of the hanging incandescent units. The new fixtures were equipped with hinged translucent Plexiglas panels which provided well-diffused low brightness illumination. The exposed frames of the fixtures were finished with off-white enamel baked at 300 degrees to provide a permanent finish. Two sizes of the same type fixture were used to accommodate the varying areas of ceiling sections which

TECHNICAL DATA

Type of work—Bank Business

Area of interior—7200 sq. ft.

Ceiling height—25'-0"

Type of luminaire—Custom designed Frink fixtures, semi-recessed units in two sizes, 5'-0" square and 4'-0" square, with Plexiglas bottom and side panels, 14 lamps per unit.

Number of luminaires—34 total of the two sizes.

Luminaire spacing—15'-0" by 15'-0", center to center.

Type of lamps—40-watt, T-12 and 30-watt, T-8; standard white.

Total lamp watts—17,160

Lamp watts per sq. ft.—2.33

Color scheme—Ceiling—white; walls—white and gray marble.

Footcandles—25, average after operation for 4 months.

were established by the many vertical marble pillars in the interior.

A close look at the technical data on this installation reveals the clear advantages of modern lighting design. Although the lighting results from the new system represent an improvement in every detail, the power requirement of the new system is approximately 30% less than the 29 kw load of the original lighting. It is also expected that the maintenance of the new system will afford further appreciable savings.

This is an effective example of how an old building can be modernized through the judicious application of light alone.

It Shouldn't Happen to a Dawg

By
BILL CRAMER

YOU TAKE A CHANCE ON A GUY WHO SAYS
HE CAN MAKE 'EM FOR A BUCK CHEAPER...

WELL-O.K.-IF
YOU'RE SURE
YOU CAN MEET
THE SPECS.

SURE! IT'S A CINCH!
I CAN MAKE YOU A
FIXTURE JUST AS GOOD
AND YOU'RE IN FOR AN
EXTRA BUCK PROFIT
ON EVERY FIXTURE...

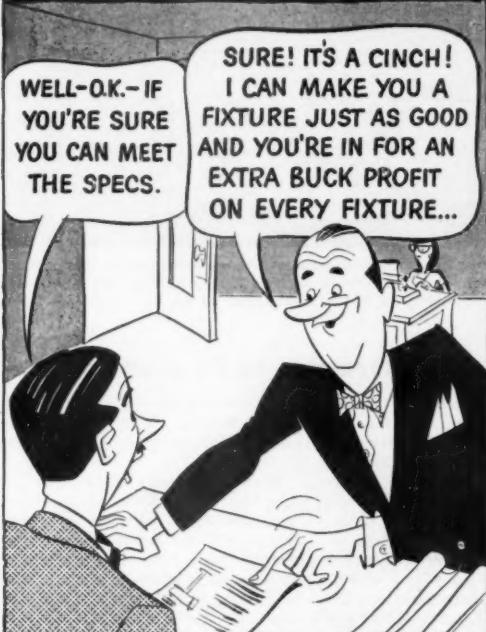
AND SURE AS YOU DO-THE TUNE THAT SOUNDED
SO SWEET ENDS UP ON A SOUR NOTE!

WE WAS ROBBED!
ANY SIMILARITY
BETWEEN THE SPECS
AND THESE FIXTURES IS
PURELY COINCIDENTAL!

THE BOSS IS
LOSING HIS SHIRT
ON LABOR COSTS
TRYING TO GET THOSE
MONSTROSITIES HUNG

—LOOK PAL. LETS
FACE IT. I SIMPLY CAN'T
DELIVER THE REST OF
THE JOB ON TIME

WHAT
NEXT?



Sell Day-Brite Quality

... and this will never happen to you

Why gamble your reputation . . . and your profits . . . on "substitutes"?

Day-Brite is one line of fixtures that protects you, both as a lighting expert and a good businessman. You don't have to guess—you *know* a Day-Brite installation delivers the kind of lighting performance you promise your customer.

That's why it's good business to sell Day-Brite

quality *always* . . . and to *stick with* Day-Brite once it's specified.

Hundreds and hundreds of contractors feel that way about Day-Brite—and profit by it. You can, too.

If you need product data or information, write Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.

In the Famous Day-Brite Line • the Viz-Aid® • the Plexoline® • the Lenox® • the Lavex® • the Ranger® • the PBM • the Day-Line® • the Tur-A-Top® • the Duo-Frame • a complete line of troffers • exit signs • wallcase, showcase and fitting room fixtures • light strip.

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 Your Assurance of
 Best Quality for Safe Use

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GEM STUDDED LEADERSHIP
JUMP ON THE

**Key size
 15 amp
 5 in a pack**

Cat. No. 400

H.E.C. CARTRIDGE FUSES 250 volts

THE NEW Display Container

MIDGET

Cat. No. 415
 1 to 30 amp. 250 volts

FUSE PULLER
 3 sizes
 MIDGET size No. 400
 POCKET size No. 401
 15 to 30 AMPERE

TYPE S FUSTATS

CAT. NO. 515 520 525 530

MAJOR FUSES
 SHOW WHEN THEY BLOW

CAT. NO. 400-D
 25 ASSORTED STANDARD SIZE PLUG FUSES TO A DISPLAY

CAT. NO. 535 540 545
 FOR FUSTAT SIZES 15, 20, 25 and 30 AMP.

INDIVIDUALLY BOXED

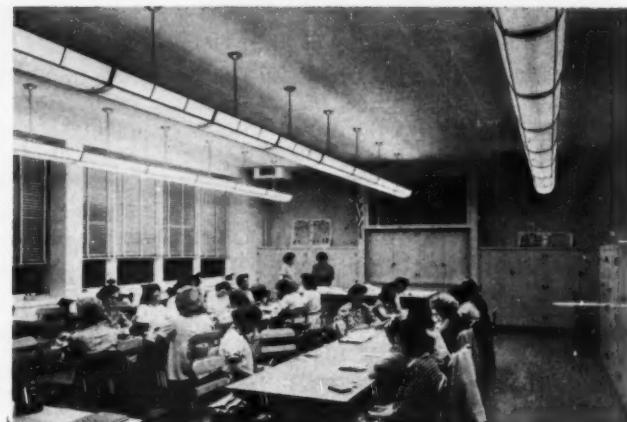
TYPE SA ADAPTERS

GLASS SIZE No. 402

SOLD THROUGH ELECTRICAL WHOLESALERS

THE FACTORY
AND KNOW HOW BEHIND
MAJOR
PLUG AND CARTRIDGE
FUSES

GEM ELECTRIC MFG. CO., Inc.
 2000 10th Street, Brooklyn, N.Y. U.S.A.



THREE ROWS of suspended 4-lamp fluorescent fixtures with luminous side panels, louvered bottoms and open tops results in high (80 footcandle) intensity, even distribution and minimum glare in this sewing room of the San Fernando (California) High School.

School Sewing Room Has 80-FC Illumination

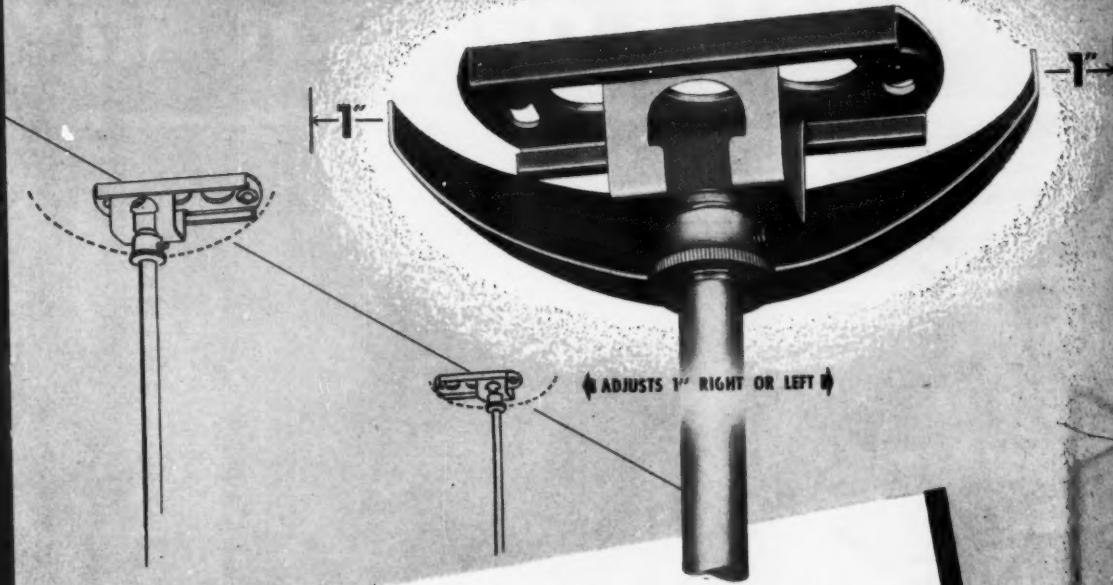
Light intensities ranging between 75- and 80-footcandles, even distribution, and the absence of excessive glare are three very important factors obtained in the lighting of the sewing rooms in the San Fernando High School, Los Angeles. These objectives became realities through the installation of 24 louvered-bottom luminous-side open-top 4-lamp 40-watt fluorescent fixtures, stem-mounted 24-inches below the 11-foot 5-inch ceiling in the 27-by-39½-foot rooms. Fixtures were arranged in three continuous

rows on 9-foot centers, each row containing 8 units. Connected lighting load is 4600 watts, or 4.5 watts per sq. ft.

With a light tan composition tile floor, light ceiling, walls and furniture, brightness ratios are low, providing ideal conditions for seeing. Wiring, controls and fixtures were installed by Sterling Electric, in accordance with the lighting plan prepared by architect Albert C. Martin in cooperation with the illumination division, Los Angeles Department of Water and Power.



TRANSLUCENT PANELS of corrugated white acrylic plastic make up a luminous ceiling for an executive office at Lone Star Cement Company, New York City. Twelve 36-inch by 40-inch panels are mounted only 4½-inches below 24 40-watt, 48-inch fluorescent lamps spaced on 12-inch centers. An average of 71 ft-c is obtained at desk level. Light diffusion eliminates objectionable glare.



Mounting Points Out-Of-Line? No Matter! New Wakefield Adjustable Ceiling Straps Correct it for You!

You don't need to waste time drilling new holes to remount straps that are slightly out-of-line. New Wakefield Adjustable Ceiling Straps slide over—up to 1" in either direction. Now standard on all Wakefield fluorescent and incandescent single-stem hangers, these straps are another example of Wakefield's "Design for Contractors" to save time on every job. Here are three additional conveniences of the new straps:

1. They mount on ceiling outlet boxes or pre-installed studs, or directly on ceiling with one or two toggle bolts.

2. They have the famous Wakefield hook-on connection, to which stems can be attached instantly.
3. They can be used with the new Wakefield 35° swivel for sloping ceilings. They take all accepted mountings without adapters. Wakefield Adjustable Ceiling Straps are made of 16 gauge steel zinc plated to resist rust, and take a 400 lb. load. We'd be pleased to tell you more about Wakefield Adjustable Ceiling Straps, and about the Wakefield Luminaires on which they are used. For information, write The F. W. Wakefield Brass Company, Vermilion, Ohio.

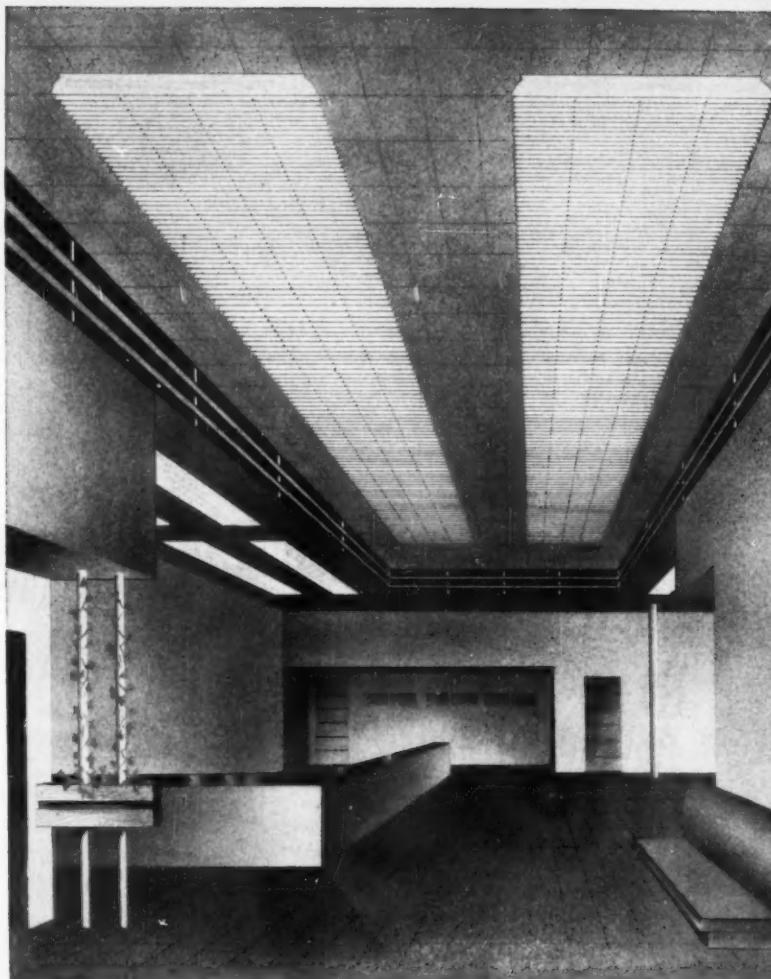
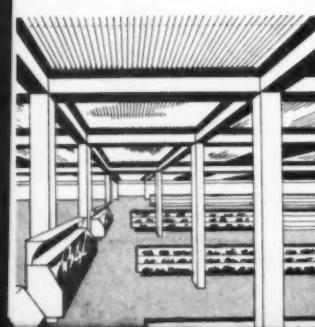
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by.....

Wakefield
Over-ALL Lighting



WAKEFIELD CEILING

NEW SALES OPPORTUNITY



These AREALUX features will close the sale

- [I]** Large area light source, very shallow, highly stylized.
- [I]** Priced comparably to standard width fixtures.
- [I]** Shipped completely assembled in one carton, ready to install, installation costs reduced to minimum.
- [I]** Each louver removed separately for jiffy-quick cleaning.
- [I]** Can be surface, suspension, or recess mounted.
- [I]** Fixtures can be joined endwise or side-
- wise, or both, for large interesting panels of light.
- [I]** As a louverall system AREALUX completely *self-contained*, the first unit of its kind.
- [I]** Highly efficient when used individually or in various combinations.
- [I]** Perfect alignment is provided by ingenious hanger arrangement and accessories with AREALUX.
- [I]** Completely wired with E.T.L. and U.L. approved ballasts. U.L. approved and I.B.E.W. A.F.L. Union Label.

FOR CONTRACTORS

LPI

AREALUX



In your community there is a lot of very bad lighting. Especially is this true of large, massive interiors and high-ceiling areas. The trouble is that old-style narrow fixtures, which have been standard up to now, *simply cannot do the job*.

The result is an ever-growing demand among contractors and architects for panel, louvered, and grid lighting. Now, at last, LPI answers this demand with AREALUX—a new and original invention inspired by ideas submitted to us by you men who are out fighting for business every day.

Every old-style lighting installation you see is a sales opportunity for you.

Here is a great selling point

Cleaning costs is a matter of serious concern to your customers, as you well know. The new AREALUX is 100% cleanable, as you will see in the two photographs below.

The panels, after being unhinged from the fixtures, are laid on the table face up, and then each louver comes out with finger-tip pressure.

The now famous LUV-R-LOK invention makes possible this new LOW in cleaning costs. Think of it! The time needed for cleaning the entire AREALUX is only 5 to 10 minutes—about 1/10 the time and effort of an old-style fixture of equal size!

Finally—and most important to you—*LPI AREALUX is extremely easy to install*.

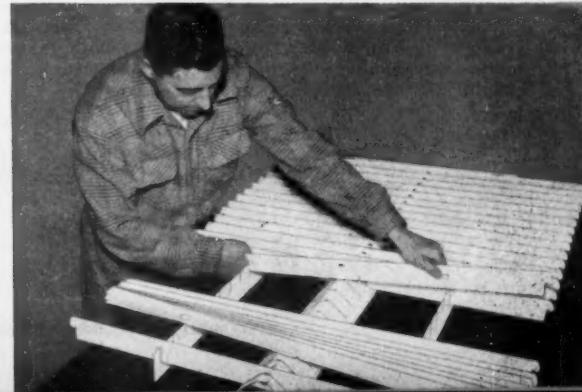
It is shipped completely assembled in one carton, ready to install—and that means money in your pocket in these days of high labor costs.

Write for FREE Catalogue

LPI's new catalogue—"New Ideas in Fluorescent Lighting"—contains full information regarding the AREALUX, installation details, photometric data, assembly instructions, full description of technical features and ease of installation. Graphically illustrated with photographs and diagrams. Write on your letterhead for your FREE copy—now. Ask for Catalogue No. 50-D.

LIGHTING PRODUCTS, Inc.

HIGHLAND PARK
ILLINOIS



KEEP IT LIGHT...

by G-E Starters



It's as simple as this: General Electric Watch Dog® no-blink starters automatically cut failing lamps out of the circuit . . . do away with bothersome blink that calls for emergency lamp replacement during working hours. Once locked out, Watch Dogs make no further attempts to light dead lamps—even when ON-OFF switching takes place. Lamps can be replaced on a maintenance schedule planned to avoid annoying interruptions during busy hours. Folder Q43-1018 gives all the facts on Watch Dog starters and their contribution to uninterrupted production. Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company

You can put your confidence in—

GENERAL  **ELECTRIC**



In The News

IES Convenes During Engineering Centennial

For ten days in September, Chicago was host to one of the greatest engineering gatherings in the United States. More than 60 engineering organizations held their annual conventions at that time to celebrate the 100th anniversary of the first engineering society in the U. S.—the American Society of Civil Engineers—and mark the birth of engineering as a profession. From September 3 through the 13th each group discussed the role of its specific branch in helping America reach its present status from the standpoint of productive capacity, commercial enterprise and living standards. Specific emphasis was placed on the role of engineering and scientific research in the past and its impact on the future.

More than 25,000 engineers spent the ten days at Convocation of Engineering sessions to hear leading engineering personalities point up the broad benefits of science and engineering to humanity; attended their individual organization conventions for more detailed and technical approaches to the subject.

One technical society which has made a tremendous contribution to American Welfare—the Illuminating Engineering Society—held its 44th National Conference during the centennial. The major portion of the five-day session at the Edgewater Beach Hotel was highly technical in nature; covered subjects ranging from circuit design and analyses to lighting applications and even the fine points of photographing street lighting installations.

At the opening session, Major Lenox R. Lohr, president of the Museum of Science and Industry of Chicago, and president of the Centennial of Engineering, welcomed IES to Chicago, pointed up the role science and engineering are playing in today's world and gave a short preview of the Centennial program.

In his president's address, Samuel G. Hibben reviewed the activities and accomplishments of IES, revealed that the greatest strides in lighting have been made within the last decade; stressed the need for better preservation of eyesight through additional study, research and application of lighting. He cited the IES technical committee program as the backbone of strength of the Society's output.



IES DIGNITARIES at the National Technical Conference were: (L to R) president-elect Everett M. Strong, Cornell University; Prof. Georges Destriu, Sorbonne (Univ. of Paris), Paris, France; Dr. J. N. Aldington, Siemens Electric Lamps & Supplies, Ltd., Lancashire, England; and outgoing president, Samuel G. Hibben, Westinghouse Electric Corp.

President-elect E. M. Strong summarized the basic objectives and programs of the Society since its founding in 1906 as research and education; suggested that the technical committees be given new implementation, new instruments, new standards and new concepts to achieve the goal of high leadership in the lighting profession. To achieve this, lighting research must expand manifold and lighting education in all its ramifications must grow in stature and volume, he warned. Professor Strong sees no reason why Illuminating Engineering must continue under the wing of Electrical Engineering and feels that it can find its own place as a profession.

General Secretary Clarence G. Kel ler reviewed the growth of the Society; noted the addition of six new chapters and two new student branches in the past year; suggested that the Society must look to regional conferences for basic technical programs.

Two of president Hibben's last official acts were the presentation of the 1952 Fellows at the opening session and presentation of the IES Gold Medal to H. Herbert Magdick, executive engineer, General Electric Company, Cleveland. Magdick received the coveted award in recognition of his "meritorious achievement which has conspicuously furthered the profession, art or knowledge of illuminating engineering." This is the highest honor in the lighting field.

More than 30 technical papers were presented under the following categories in nine sessions during the conference.

General Sessions—Darrel B. Harmon, consulting educationist, Austin, Texas questioned whether we are confusing "eyes" with "vision." Delving into the physiology of vision, Harmon pointed out that brightness patterns cannot be determined solely in terms of brightness or contrast interference with recognition. Also to be taken into consideration is the fact that much of the nervous circuiting from the periphery of the retina leads directly to body posturing mechanisms. Lighting engineers must be concerned with visually-centered performance, visual learning and visually related body-mechanisms, he added.

Brightness difference as a basic factor in suprathreshold seeing was explored by S. K. Guth, A. A. Eastman, and R. C. Rodgers, General Electric Co., Nela Park. The brightness difference concept affords an interesting approach to a better understanding of benefits available from higher illumination levels, they stated. H. R. Blackwell, University of Michigan, reported on the results of a research project covering determination of brightness discrimination data: concluding that such data will permit specification of quantity of illumination for any level of accuracy from 50 to 99 percent, and for any speed of bright-

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RELATIONSHIP BETWEEN LIGHTING
and vision is discussed at Chicago IES National Technical Conference by: (L to R) D. B. Harmon, Austin, Texas; Thomas F. Coglan, electrical engineer, P.B.S., Washington, D. C.; and Theodore D. Wakefield, vice-president, The F. W. Wakefield Brass Co., Vermilion, Ohio.

ness discrimination from one per second to 10 per second.

The application of silhouette lighting with a self-luminous background for assembly of fine wires in electronic tubes and similar tasks was described by Willard Allphin, Sylvania Products, Inc.

J. R. Jones and John J. Neidhart, Westinghouse Electric Corp., explained the Zonal Method of computing coefficients of utilization and illumination on room surfaces. They believe this is a more satisfactory system because disposition of luminaire lumens in each 10° zone is determined, the coefficient of utilization may be calculated for areas having floor reflectance of either 14 or 30 percent, and average illumination of walls and ceilings may be easily determined.

Degrees of comfort and visibility at the seeing task heretofore unrealized can be attained, according to George P. Wakefield, F. W. Wakefield Brass Co. Control and measurement of directional flux is one answer presented by Wakefield. He believes that an instrument for measuring the reflected directional component is practical.

A paper which catalogued and analyzed representative samples of visual tasks encountered in the grade schools were presented by J. M. Ketch and C. J. Allen, General Electric Co. As a result of this research, Ketch and Allen conclude that any improvement in visibility must be obtained by improving illumination and environmental conditions; selection of better-than-average printed material for any specific grade; and better supervision of office-duplicated materials plus emphasis on students writing larger with heavier pressure with softer, blacker pencils on good reflectance paper.

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CONTRACTOR'S ROLE in influencing type of lighting fixtures which go into an installation is discussed by Carl O. Christensen (left), manager, lighting and lamp sales, Crescent Electric Supply Co., Dubuque, Iowa; and Charles Schneider, president, Electro Silv-A-King Corp., Chicago. Place: National IES Technical Conference in Chicago.

An interesting paper on the cost and comfort appraisal of industrial lighting systems was presented by G. J. Taylor and R. D. Bradley, Day-Brite Lighting, Inc. Included was a table analyzing 19 industrial luminaires from the standpoint of lighting delivered, cost, comfort and maintenance. The authors believe that quality in an industrial lighting system is as essential as for offices; that adequate illumination levels are needed, lighted colored surroundings, and more consideration of lamp shielding and upward component of light is necessary.

Sources and Circuits—More attention should be given to vertical illumination, Dr. J. N. Aldington, director of research, Siemens Electric Lamps and Supplies, Ltd. of England told the conference. As for light sources, he believes that while no major advance appears likely in the tungsten filament field, the possibilities with more selective radiators have not been exhausted. Sodium lamp development appears to have reached nearly the optimum while further potentialities exist in the case of mercury lamps and the field of fluorescent lamp should be constantly re-examined, he concluded.

Additional information on developments in low pressure mercury discharges was given by George Meister and T. H. Heine, Westinghouse Electric Corp., Lamp Division, who discussed the use of Xenon-Argon and Xenon-Neon gas mixtures. Description and application of four mercury lamps with integral reflectors were presented by E. B. Noel and E. A.

Lindsay, General Electric Co., Cleveland. The 100-watt flood and spot lamps are in PAR-38 bulbs and the 400-watt standard and color improved units in R-52 bulbs. Basic advantages of these units are reduced lumen depreciation and less maintenance required.

In the fluorescent lighting field, lamp behavior, color rendition, new circuits and starters, and high frequency circuits were evaluated. E. F. Lowry, Sylvania Electric Products, Inc., revealed that improved cathode design and formulation has increased the expected life of most fluorescent lamps to approximately 7,500 hours. The most economical operating life of the present day 40-watt lamps is about 6,000 hours (due to efficiency depreciation with continuing operation common to all lamps), he concluded.

With increasing critical interest in color, there is a need for a method of designating the color-rendering qualities of various so-called white light sources, stated A. C. Barr, C. N. Clark and Joan Hessler of General Electric Co. They reported on research designed to develop a workable system of evaluating these qualities.

Design and operating features of the new rapid-fire fluorescent lamp and ballast system were described by A. E. Lemmers and W. W. Brooks of the General Electric Co. Both feel this new combination offers the lighting industry new concepts in high quality, rapid-starting fluorescent lighting with considerable reduction in ballast materials.

A new lead-lag ballast for discharge lamps was described in detail by C. H. Burns and H. E. Bachman, Westinghouse Electric Corp. The authors believe the new circuit has all the advantages and none of the disadvantages of existing circuits and can be used with practically all of the slimline lamps and certain preheat type lamps.

The present status of high-frequency fluorescent lighting was outlined by J. H. Campbell, H. E. Schultz and D. D. Kershaw, General Electric Co., Cleveland. The development of the magnetic frequency converter and use of 360 cycles will give lighter weight fixtures (small ballasts), less heat loss at fixtures, more lumen output per lamp, regulated lumen output, silent operation and reduced stroboscopic effect. While the status of high-frequency fluorescent lighting has shifted from the realm of possibility to that of strong probability, the economics of frequency conversion must be improved to justify widespread use, the authors concluded.

Daylighting — Daylight reflected from the ground can contribute considerably to room illumination. Methods of directing and using this

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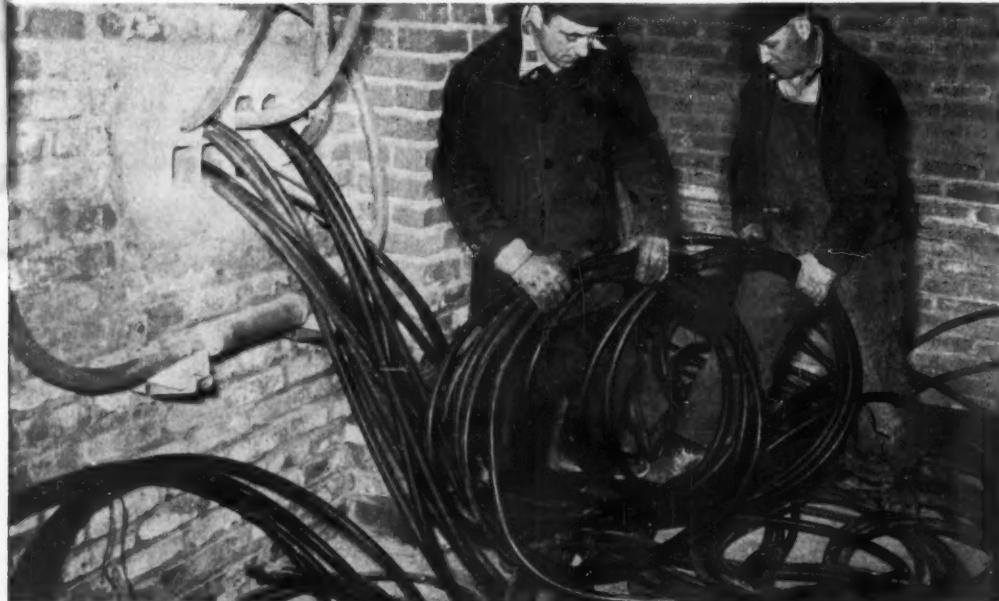


Entrance to State Hospital at Philadelphia

A newly modernized electrical distribution system is now in operation at the Philadelphia State Hospital.

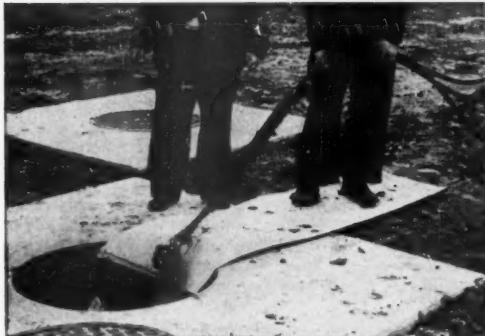
Part of the extensive modernization program was the installation of eleven miles of durable neoprene-jacketed cable, replacing lead-sheathed cable that had become unserviceable due to electrolytic attack.

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HONORED AT CHICAGO Centennial of Engineering was engineer Clarence Decatur Howe (left), Minister of Defense Production of Canada, who received the Hoover Medal from the former U. S. president at Chicago. Here, Mr. Howe is chatting with Major Lenox R. Lohr, Centennial president, at opening of the IES National Technical Conference in Chicago.

plus light source was the subject of a paper by J. W. Griffith, O. F. Wenzler (Libby-Owens Ford Glass Co.) and E. W. Conover, Southern Methodist University, Dallas, Texas. The use of horizontal and vertical louvers to control and redirect daylight for school room illumination was described by H. S. Bull, University of Michigan, who worked on a research project at the university under the sponsorship of the IES Research Trust Fund.

A lumen method of daylighting design—to predict daylighting for interiors—was explained by R. L. Biese, Jr., W. J. Arner and E. W. Conover, Southern Methodist University, Dallas. The authors believe the method to be simple and applicable to almost infinite number of room sizes, shapes and window arrangements—a tool which should prove useful in the architectural and engineering design of daylighted buildings.

R. A. Boyd, Daylighting Laboratory, University of Michigan, gave the conference additional information on the importance of room decoration when school classrooms are penetrated with light-directing glass block. He concluded that the attainment of quality daylighting in school classrooms is largely dependent upon the reflectance of the room surfaces.

The use of a photographic recorder and physical brightness meter to make daylighting surveys in classrooms was explained by W. H. Billhartz, H. F. Kingsbury and R. W. McKinley, Pittsburgh Corning Corp.

Outdoor Lighting—Street and aviation lighting highlighted this session. Since pavement brightness is an important factor influencing a driver's ability to see at night, D. M. Finch, University of California, and R. B.

Marxheimer, Kaiser Engineers, Oakland, devised a method of measuring pavement brightness. The preliminary data obtained and reported warrant further study of highway surfaces and additional field work is being planned by the authors.

C. H. Rex, chairman, sub-committee on Standard Practice, Street and Highway Lighting Committee, IES, listed some of the new features of the proposed American Standard Practice for Street and Highway Lighting—a revision of the 1947 "Standard" now quite widely used.

Specific techniques of securing realistic-appearing photographs of street lighting installations were outlined by T. Knowles and D. A. Toenjes, General Electric Company; while Charles Marsh, Pennsylvania State College, described the application of photographic methods to photometry. The kinorama—a device developed to introduce the kinetic element into evaluation of lighting configurations—and its application to aviation lighting problems was described by F. C. Breckenridge of the National Bureau of Standards.

Applications—To develop more representative maintenance factors for commercial lighting equipment, R. L. Oetting and J. W. Tuttle, General Electric Co., tested a group of offices at Nela Park. Results of washing and relamping all fixtures in 13 offices, and refurbishing some ceilings and walls, showed a footcandle increase ranging from 4.2 to 61.3 percent. From a continuance of this survey, the authors hope to uncover improved methods of washing and development of realistic maintenance factors for this type of equipment.

Four years of experience with luminous ceiling installations has uncovered some poor design features. Dr. D. E. Spencer, University of Connecticut, and L. F. Martin Electric Products, Inc., Somerville, Mass., enumerated numerous past mistakes; concluded that such installations can be designed with high maintenance factors, and lifted out of the luxury class.

Merle E. Keck, Westinghouse, discussed the photometric characteristics of directionally adjustable luminaires. Visualization of illumination results from overlapping light patterns of such fixtures can help the engineer plan a better lighting installation where adjustable units are necessary.

The Navy's newest submarines now have lighting intensities ranging from 10 to 30 footcandles, Dean Farnsworth, U. S. Submarine Base, New London, Conn., told the lighting engineers. "Tuck-in" fixtures using 8-watt, 12-inch fluorescent lamps solved the space limitation problem, he revealed.

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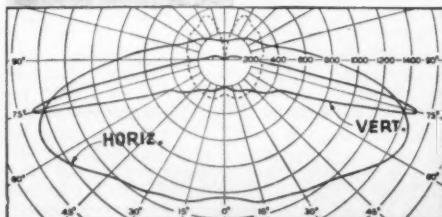
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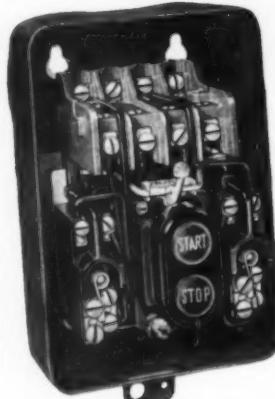
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Electric MOTOR CONTROLS



CONTEST WINNER Earl R. Domoney, Consumers Power Co., Saginaw, Mich., tells IES Lighting Service Forum how he and the electrical contractor helped relight a small church within a limited budget. Domoney took first award in National "My Most Interesting Lighting Job" Contest.

Aileen M. Page, General Electric Co., appraised the design factors and lighting results of built-in "structural" lighting in the home. To do a good job, skilled lighting consultation, advanced planning, coordination of lighting design and interior finishes, and a flexible budget are needed, she warned.

Lighting of various residential areas, from mirrors to luminous ceiling bathrooms, was the subject of the residential lighting forum. Participating in this session were: Edith L. Buchholtz and Myrtle Fahsbender, Westinghouse; Katherine Goodall, Philadelphia Electric Co.; Thomas Smith Kelly, New York; Marianne Willisch, Chicago interior designer; and Eugene W. Commyer, General Electric Company.

Contest Is Popular

The Lighting Service Forum, under the chairmanship of Lee E. Taylor, Detroit Edison Company, proved to be one of the most popular of the conference sessions. The program presented five Regional winners of local "My Most Interesting Lighting Job" contests. Each man was out to win top honors in this National Contest. Judging the oral presentations were: Samuel G. Hibben, Everett M. Strong, Willard Brown, C. L. Crouch, Joseph S. Schuchert, and A. H. Manwaring.

Top award of \$100 went to Earl R. Domoney, Consumers Power Co., Saginaw, Mich., who represented the Great Lakes Region. The combination of his engineering skill and the ingenuity of the electrical contractor on the project permitted the relighting of a small church within an extremely limited budget.

Hugh S. James, Duquesne Light Co., Pittsburgh, took second award honors

(\$50) with his relighting of a Mosque in Pittsburgh.

Third award (\$25) went to H. Neil McIntyre, General Electric Co., Lynn, Mass., for his interesting entry on the fluorescent lighting of an apron area at an airport.

Carl H. Johnson, Chicago architect and engineer, represented the Midwest Region with a bank relighting entry. Roy E. Bevan's entry (Southern California Edison Co.) covering the floodlighting of a stained glass church window represented the South Pacific Region. Those attending this forum voted unanimously for a similar session next year.

Another session boasting a "standing-room-only" attendance was the report of the IES Committee on Progress. Presented by T. C. Sargent (Sylvania Electric Products, Inc.), chairman of the committee, this evening session covered the gamut of lighting progress in lecture-demonstration format. It lost not a single delegate during its attention-holding two-hour length.

Social activities arranged by the local Chapter committee included a Roaring Twenties party, president's reception, banquet and dance at the Edgewater Beach Hotel's famous Marine Dining Room, tours, luncheons and radio show attendance for the ladies.

Hoyle P. Steele, Benjamin Electric Mfg. Co., was chairman of the National Technical Conference Committee. Ralph Raymond, Commonwealth Edison Co., Chicago, was chairman of the Conference Executive Committee. Clarence B. Pederson, Illinois Bell Telephone Co., was vice-president; Glen G. Boyd, Public Service Co. of Northern Illinois, was secretary and Charles N. Laupp of Milwaukee was Regional Representative.

McDermott Joins K. C. Electric Association

John S. McDermott became executive manager of The Electric Association of Kansas City on September 1. His appointment followed the resignation of Robert J. Samson who joined the Kansas City staff of Arthur Young and Company, certified public accountants.

Prior to his appointment, Mr. McDermott was associated for five years with radio station KMBC in special events, promotion and sales. For more than four years prior to that, he was publicity director for the Chamber of Commerce of Kansas City. He is president of the Junior Chamber of Commerce, is a member of the Board

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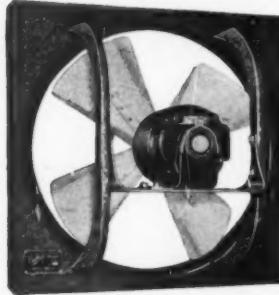
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Switchgear Production May Slow Down

At a meeting of the Switchgear Manufacturers Industry Advisory Committee with the National Production Authority late in September, members of the Committee told NPA that their allotment of steel for the first quarter of 1953 is so small it will "inevitably" cut their production 25% or more.

NPA told Committee members that mill production capacity has been fully taken up through the first quarter, and that no additional CMP allotments can be issued now. NPA explained that the switchgear manufacturers will be receiving, in the first quarter, delayed shipments of steel products originally supposed to be delivered in the fourth quarter of this year. This "carry-over" steel will be in addition to allotments for the first quarter, NPA said.

Only AEC and military programs have received 100% allotments for the first quarter of 1953, and civilian product makers have advanced allotments amounting to 60% of third quarter 1952 allotments.

NISA News

With the end of the vacation season, local chapters of NISA are ready to resume their regular monthly meetings and a number of meetings are already scheduled for September and October.

Walter J. Prise of the Maintenance Company, New York, has been asked to preside at a special meeting of the American Institute of Electrical Engineers to be held at the time of the General Meeting in New York in January of next year.

This meeting, sponsored by the Rotating Machinery Committee, will be devoted to Problems of Maintenance. Sam Heller of Consolidated Electric Motor Company of New York will speak at this meeting on the subject of "Quality Motor Repair". There will be a number of other speakers on topics pertaining to problems of the Maintenance of Electrical Equipment. The program should be of great interest to all concerned with keeping electrical equipment running.

NISA members really have something to look forward to Oct. 16-19



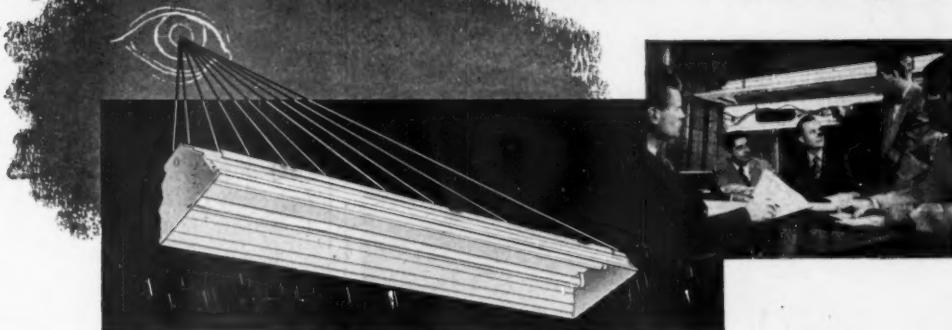
PRE-SESSION HUDDLE at IES Conference in Chicago is enjoyed by: (L to R) Edward Rambusch, Rambusch Decorating, New York; Roy A. Palmer, Duke Power Co., Charlotte, N. C.; C. M. Cutler, General Electric Co., Nela Park; and Hoyt P. Steel, Benjamin Electric Mfg. Co., and national conference committee chairman.

when the Southeastern Chapter's convention gets under way at the Sherry Frontenac Hotel in Miami Beach, Fla. Registration will be held from 1 to 6 PM., Thursday, Oct. 16. The President's Reception follows at 8 PM. Final registration takes place Friday, 8 to 9:30 AM., for those who have not returned advance registration cards. R. A. Scherer, president, NISA, will address the group, and his remarks will be followed by the Technical Session.

The committees are: Lewis S. Bain, Jack's Electric Motor Repair, Fort Lauderdale, Fla., Convention Chairman; H. Ed. Grant, Tennessee Electric Motor Service, Nashville, Publicity Chairman; Louie W. Cleveland, Cleveland Electric Co., Inc., Atlanta, Manufacturers' Displays; W. S. Ward, Electric Motor and Repair Co., Raleigh, N. C., Programs and Badges; William C. King, King Electric Motor Service, and Michael E. Assalone, Florida Electric Motor Co., Miami, Hotel Registrations; Oscar A. Clot and Jimmy Roper, Peninsular Armature Works, Miami, Transportation, Sightseeing and Fishing Trips; H. Ed. Grant, Tennessee Electric Motor Service, Nashville and Howard A. Lilly, Tampa Armature Works, Inc., Tampa, Technical and Administrative Forums; Oscar A. Clot, Peninsular Armature Works, Miami, Chairman, Program Committee; Lewis S. Bain, Jack's Electric Motor Repair, Fort Lauderdale, Fla., Chairman, Entertainment Committee; Mrs. Frances King and Chris Bain form the Ladies' Committee.

The standing Convention Committee met in New York with the local committee at the Hotel Statler, July 26, to discuss plans for the 1953 NISA Convention, May 24-28. The meeting lasted a full day and was attended by

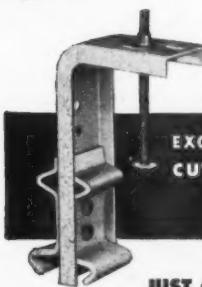
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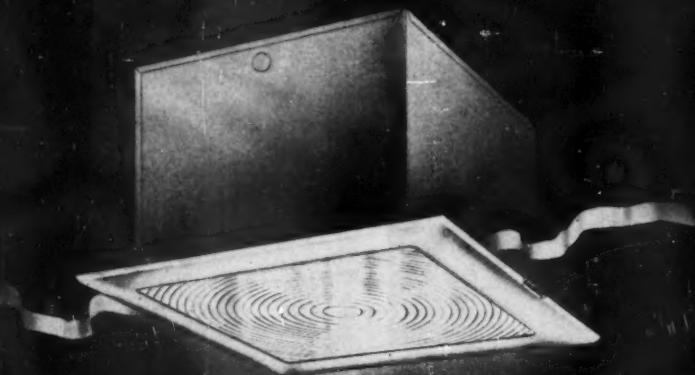
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For Complete Details—Write for Bulletin DC-1



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RADIANT HEATING, one of many electrical fields appealing to Joe Lamperdi, owner of the North Bay Electric Company in San Rafael, California, calls for a thorough investigation of prevailing weather conditions, type of building construction, cubicle capacities and type of occupancy.

tric Service and White Electric Motors, Lowell, Mass. He had been sales manager of the company for the last eight years.

Youngstown, Ohio, held its second meeting July 15. Eight companies were represented, including the original seven firms who met June 10 to form the new group and an eighth member, Sheridan Electric Co., Youngstown. The new chapter member is also a newcomer to NISA. President W. H. Gruber, The Phoenix Electric Co., Youngstown, reports that "from dinner at 6:30 to 11:30 P.M. many problems were discussed in a very pleasant atmosphere which promises much for the future. We also adopted a set of by-laws similar to the Greater St. Louis Chapter's bylaws."

Los Angeles Chapter held its regular meeting August 12, with a Field Trip to Anaconda Wire and Cable Company's plant at Orange, California. The trip was sponsored and arranged through the courtesy of Tri-State Supply Corporation of Los Angeles, Calif. Refreshments and buffet supper was served. Originally all activities were to be centered at the Wire Plant, but due to a record attendance of over 200 the festivities were transferred to the Elks Temple of Orange, Calif. Chairman Hogue welcomed all the guests and members and introduced Chairman John Lough of San Diego Chapter. Approximately 20 came up from San Diego in a group. The trip through the plant was most interesting. Visitors saw the drawing of copper wire and the insulating of same.

M. Friedkin who just returned from vacation on Cape Cod stopped in Bos-

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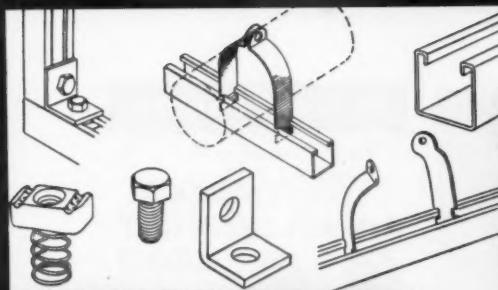
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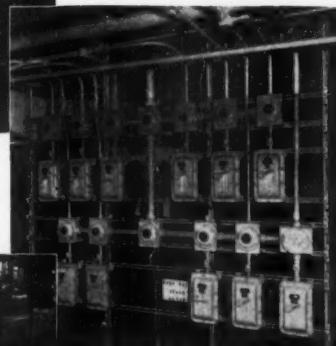
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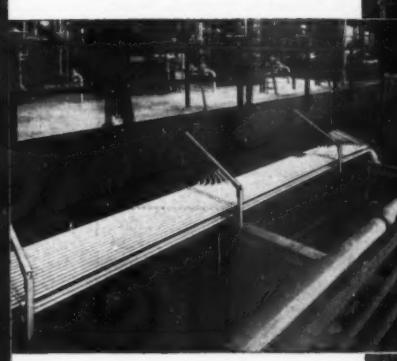
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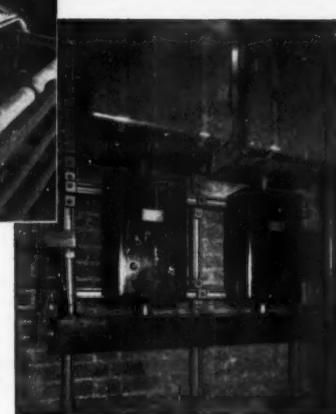
Stanchions and trapeze supports of UNISTRUT carry high voltage and metering conduits in a Lilly tunnel installation.



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ENGINEER Carl H. Lundell (right) of City of Portland, Oregon, gets additional information on lighting at recent I.E.S. Technical Conference in Chicago from S. F. Davies, Westinghouse Electric Co., Cleveland.

ton for the first New England Chapter meeting, his report follows: "The new shops of Electrical Maintenance Company, Northeastern Electric Company and Sandman Electric Company were inspected by more than 150 NISA members, prior to the September 11th New England Chapter (Boston) meeting at the Bradford Hotel. All of these new spacious shops are very well equipped with the most modern facilities for doing the best type of motor repairs in accordance with the highest NISA standards. It is preferable to see these fine establishments first-hand in order to fully appreciate them as a good example of what NISA inspiration brings forth in better and brighter workshop values."

• • • •

The Central District Chapter held a meeting on Tuesday, September 9th at the Electric Club, 20 North Wacker Drive in Chicago. Our program was "Quiz Session" devoted to problems of shop and business practices in electric repair shop. President Lessel was moderator for the panel of four: Art Johnske, Excel Electric Service Co., Bill Luehker, Hyre Electric Co., Paul Martin, Northwestern Electric Co., Paul Sievert, Sievert Electric Co. The meeting proved to be a very interesting and lively one.

From Walter J. Prise, The Maintenance Co., New York, N. Y.

Proposed Electrical Code Changes

Proposed changes for the 1953 National Electrical Code have been released by the National Fire Protection

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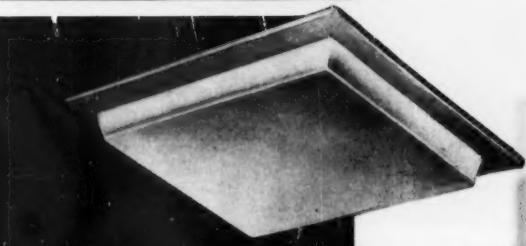
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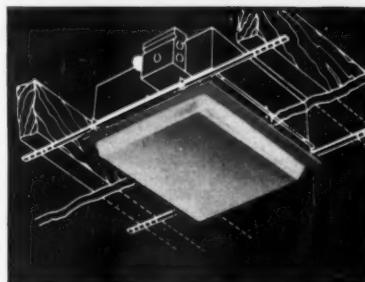
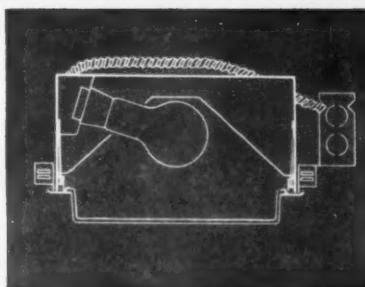
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Based on the 1951 Edition of the National Electrical Code

By B. Z. Segall

Registered Professional Engineer

Volume 1

754 pages, 8½ x 11, over 1300 illustrations, \$12.50

If you're an electrician, electrical engineer, utility man, architect, builder, contractor, or anyone else who is responsible for designing or doing wiring, you'll find this book one of the most practical means for understanding the National Electrical Code. You can find the meaning and purpose of a particular Code rule in seconds, since the diagrams in the book are numbered exactly as the Code. And, besides the diagrams and pictures, the book also gives you background material explaining the why of the Code.

ELECTRICAL CODE DIAGRAMS was first published privately by the author some years ago. Even with this limited distribution, thousands of copies were sold—proving its worth to those in practical electrical work, in school and industrial training programs, and as an ideal means of keeping up with the Code. Now brought fully in line with the 1951 Code, this first volume of a two-volume work covers important, practical chapters of the Code, dealing with wiring design and protection, and wiring methods and materials.

• BIG

No tiny, thumbnail sketches in this book... but hundreds of big, clear pictures... on pages as large as this magazine.

• CLEAR

Diagrams are electrically complete, but reduced to essentials to make Code features stand out.

• THOROUGH

A diagram or picture for every Code rule, parts of rules, exceptions, etc.

Association, sponsors of the Code. Published in NFPA Pamphlet No. 70-PR1, the changes, proposals not recommended and items remaining on the dockets of the various "Code Making Panels" are detailed and circulated for public comment. A deadline date of December 1, 1952, has been established for all comments if they are to receive Committee consideration prior to the final drafting of the 1953 Code.

Copies of the pamphlet are available from NFPA Publication Services, 60 Batterymarch St., Boston 10, Mass. The cost is \$2.00 per copy.

Some of the significant proposed changes and additions follow. Electrical receptacles will henceforth be required to be designed so that they cannot be used interchangeably in different circuits of different voltage, frequency or types of current (ac or dc). New rules are proposed to safeguard users of portable equipment and electric clothes dryers by more effective grounding means. Liberalization of the use of armored cable in the air voids of cinder block walls is suggested except where subject to excessive moisture or dampness.

An entirely new article is submitted on mineral insulated-metal sheathed cable proposing its use for services, feeders and branch circuits in both exposed and concealed work, in dry or wet locations, under plaster or embedded in plaster, brick or other masonry. Necessary changes in the balance of the Code to incorporate this type cable are also detailed. Proposed revisions in the use of new types of non-metallic sheathed cable are specified with comments by the Panel members on the feasibility of the changes.

Significant changes are proposed for the section of the Code dealing with "hazardous locations", particularly Articles 500 and 510. Recognition has been given to positive pressure ventilation arrangements to reduce the area considered hazardous when such ventilation is safeguarded by duplication of equipment or interlocked with the electrical supply. Definitions of hazardous atmospheres are more closely defined to aid in applying the rules.

Perhaps the most sweeping changes of all are in Article 510 where complete new rules are proposed for commercial garages, residential garages, aircraft hangars, gasoline service stations, bulk plants storing flammable liquids, paint, lacquer and similar finishing process areas, and where combustible anesthetics are used.

Emergency lighting systems, as are generally required for hotels, theaters, sports arenas, hospitals and similar institutions also receive a complete new treatment.

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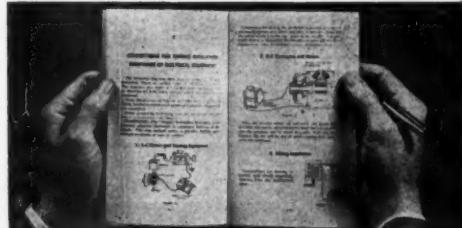
"We have found the 'TTR' Set was successful in detecting a shorted section of turns in a transformer in operation, which permitted it to be taken out of service before more serious trouble developed."



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Book Reviews

Direct-Current Machinery

Principles and practice of direct-current generators and motors and their auxiliary equipment are covered in the 319-page book "Direct-Current Machinery", by Charles S. Siskind, M.S.E.E., Assistant Professor of Electrical Engineering, Purdue University. Developed at the level of the engineering student, the material in this book treats of the design and construction of dc machines, with theory and practical examples stressing the interrelation between electric and magnetic circuits.

Beginning with the fundamentals of action and reaction in the dynamo, the book includes chapters on: Armature Windings; Interpoles and Compensating Windings; Generator Operation and Performance; Motor Characteristics; Control of Motors; and Special Machines, Circuits and Applications. The range of topics follow one another in logical sequence, with important subjects emphasized by repetition and by solution of typical problems. Mathematics involved are clear and complete, assuring a sound quantitative understanding of the operation of the various circuits.

The text is clearly written for easy understanding. A wealth of sketches, graphical constructions, photographs, wiring diagrams and charts is closely related to the development of the text and affords a full explanation of the more complex design and operating details. The numerous problems associated with dc machines are based on actual cases in industrial application, and the solutions represent the author's experience with direct-current machinery, both in industry and in teaching.

The book is well indexed and contains a bibliography of available books, bulletins and articles on related subjects. The 9-in. by 6-in. volume is published by the McGraw-Hill Book Company, 330 West 42nd Street, New York, 36, N. Y. It is priced at \$6.00.

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Technique of Stage Lighting

The lighting of the stage is generally considered as a highly specialized art, dealing principally with the artistic and fantastic aspects of dramatic and spectacular lighting. Because of this

generalization, even by architects, engineers, contractors and lighting men, its design and application is usually left to be worked out by the theatrical producers in collaboration with the manufacturers of critically-designed optical lens spotlights, color lighting devices and other highly specialized lighting units. These specialty lighting manufacturers have done an excellent job, generally, in providing lighting devices which produce the spectacular lighting effects planned by theatre experts. For these reasons, all too few architects, engineers, lighting men and others know very much about the scientific, engineering and artistic considerations of stage lighting.

This is perhaps unfortunate, for the reason that practically all lighting application is appropriately defined as "an art" as well as "a science", and the underlying principles of stage lighting may well be utilized in the solution of any lighting problem. This is especially true in lighting sales areas—show windows, sales rooms, display areas, etc. In fact, some few artisans in the industry apply stage lighting principles to normal commercial lighting design application almost exclusively.

Now electrical contractors, engineers, architects and lighting men generally can do something about this. They can get the whole story on the underlying principles and fundamentals of stage lighting in one compact package, in a 1952 revised edition of "The Technique of Stage Lighting". This edition, a revision of the first edition published in 1947, is divided into four Sections for reference simplification.

Part I covers the "Scientific Basis", and is devoted to vision and color, and the control and measurement of illumination.

Part II covers "The Adaptation and Control of Light", and is divided into five chapters.

Part III covers "The Art of Stage Lighting", and will appeal to almost anyone who has an interest in lighting application work and the artistic considerations of light as a decorative medium.

Part IV covers "Practical Lighting for Stage Productions", which deals with practical problems.

This book paves the way for great advance in techniques and artistry not only in theatre lighting, but in allied fields. It has been written by R. Gillespie Williams. It is fully illustrated, containing 71 black and white pictures or drawings, and six color plates. It contains 196 pages, size 5½-inches by 8½-inches. It is published by Pitman Publishing Corporation, 2 West 45th Street, New York, N. Y. Price is \$6.00.

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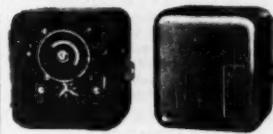
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Among the Manufacturers

Headquarters Announcements

National Electric Products Corp., Pittsburgh, Pa.—Luther D. Shank, assistant to the vice-president and general sales manager, and in charge of Pittsburgh district sales.

Burndy Engineering Co., Inc.—Eric DeMarsh, vice-president in charge of sales.

General Electric Company, Schenectady, N. Y.—August R. Ryan, sales manager for furnaces and associated equipment, Industrial Heating Department.

S & C Electric Company, Chicago, Ill.—John R. Conrad, president.

Wagner Electric Corp., St. Louis, Mo.—J. C. Evans, assistant controller.

Clark Controller Co., Cleveland, Ohio.—Robert Whitehill, assistant general sales manager; L. H. McClure, manager of marketing.

The Onokite Co., Passaic, N. J.—Julius G. Dersie, manager of utility and industrial sales for the New York district.

BullDog Electric Products Co., Detroit, Mich.—John B. Cataldo, director of research and development.

Regional Appointments

NEW ENGLAND

Markel Electric Products, Inc., and La Salle Products, Inc.: Morton Sable, Boston, Mass., sales representative for the New England territory.

MIDDLE ATLANTIC

Syntron Company: has opened a sales and service headquarters of the Syntron Newark Sales Company in Hasbrouck Heights, N. J.

General Electric Company: L. S. Brungard, manager of the apparatus sales office, Trenton, N. J.

BullDog Electric Products Company: Arnold S. Larsen, field engineer in the New York office.

SOUTH ATLANTIC

General Electric Company: E. H. Powell, assistant manager of the apparatus sales office, Richmond, Va.

Leader Electric Company: Mel Knox, representative for the Washington, D. C. area.

BullDog Electric Products Company: Kirklin L. Kelly, field engineer in the Huntington, W. Va., territory.

WEST CENTRAL

Sterling Electric Motors, Inc.: Herbert F. Ziegler, Jr., manager of the Kansas City, Mo., district office.

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Obsolete Centrifugal
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LEWUS RELAY

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An ideal replacement for motors in dirty and hazardous locations

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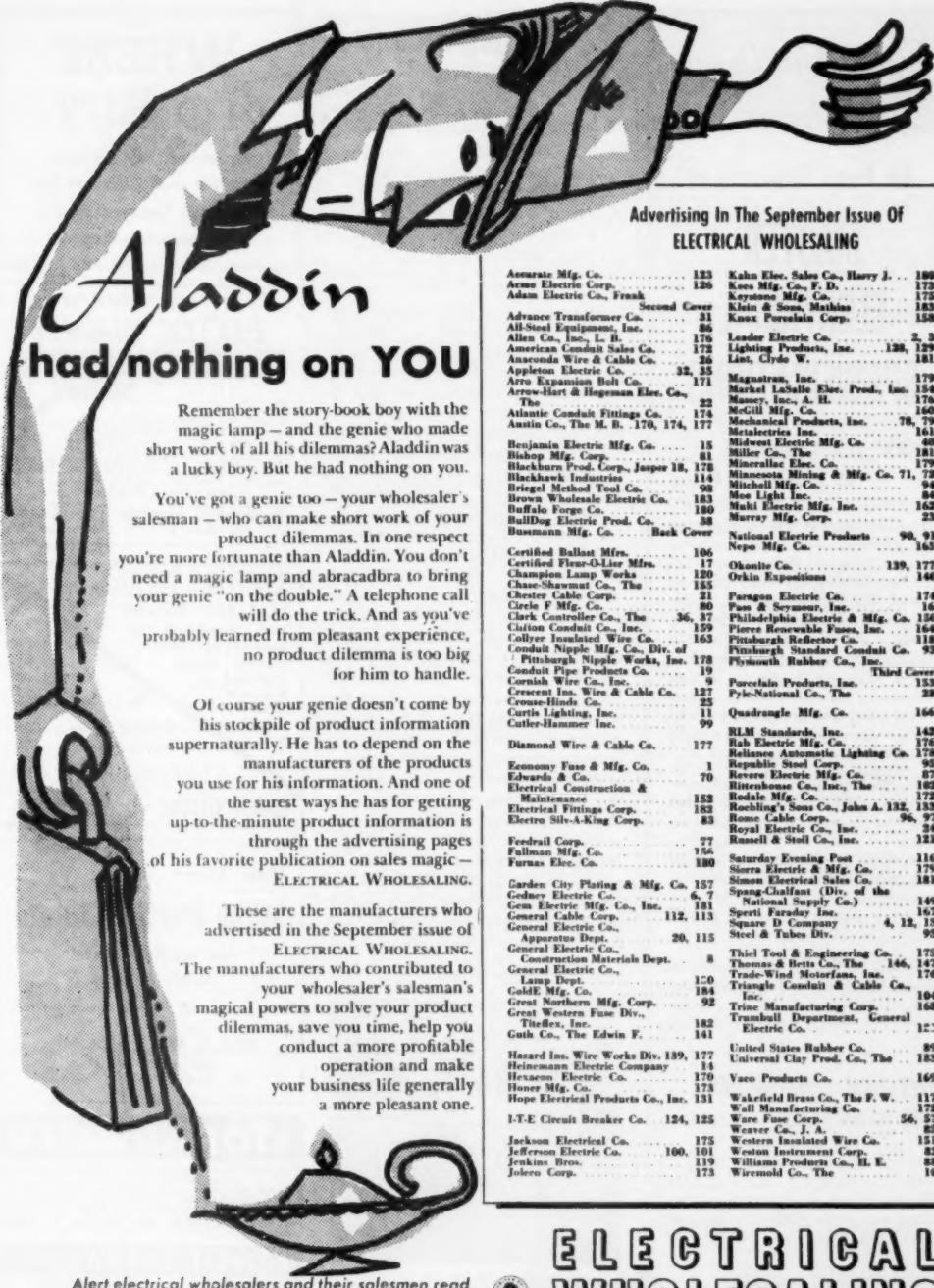
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You've got a genie too — your wholesaler's salesman — who can make short work of your product dilemmas. In one respect you're more fortunate than Aladdin. You don't need a magic lamp and abracadabra to bring your genie "on the double." A telephone call will do the trick. And as you've probably learned from pleasant experience, no product dilemma is too big for him to handle.

Of course your genie doesn't come by his stockpile of product information supernaturally. He has to depend on the manufacturers of the products you use for his information. And one of the surest ways he has for getting up-to-the-minute product information is through the advertising pages of his favorite publication on sales magic —

ELECTRICAL WHOLESALING

These are the manufacturers who advertised in the September issue of

ELECTRICAL WHOLESALING

The manufacturers who contributed to your wholesaler's salesman's magical powers to solve your product dilemmas, save you time, help you conduct a more profitable operation and make your business life generally a more pleasant one.

Alert electrical wholesalers and their salesmen read

ELECTRICAL WHOLESALING

The National Magazine of Electrical Wholesale Distribution

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ELECTRICAL WHOLESALING



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\$1.00 per copy. Enclosed is my re-
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Company

Address

SPARE PARTS VS STANDBY UNITS (FROM PAGE 105)

are identical to or interchangeable with motors in the particular department. A cross-file of motors by characteristics has been compiled as an important tool for maintenance analysis.

g. The down-time required for maintenance of each motor in case of total failure.

Program Control

Effective use of this extensive inventory analysis depends heavily upon careful attention to the availability of supplies. Each of the participating maintenance groups must be alert to such conditions as shortages, restrictions and allocations. A good working relationship is maintained between the maintenance department and the purchasing department. Skillful ordering of parts and equipment goes a long way toward effective maintenance.

Recently, the electrical maintenance department was advised by the purchasing department of a year's backlog of some alloy steel shaftings. Because the electrical department machines its own shaftings, this advice prompted early buying of the steel, avoiding snags later on. Here, the purchasing department played an important advisory role in keeping maintenance informed of current trends.

With this kind of background action, the inventory of maintenance supplies is tightly geared to every phase of plant production. As a result, the inventory is neither excessive nor inadequate. But above all, this standard procedure for balancing the inventory has solved the problem—spare parts vs standby units.



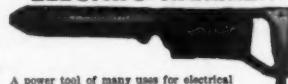
MOTOR CONTROL is subject of discussion between Henry Rosenkranz (left), Allen-Bradley Co., Milwaukee; Ernest Olson, Olson Electric, Inc., Union City, N. J. and Edward Everts, Domizio & Everts, Inc., Yonkers, N. Y.

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Maintenance—Repairs**

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Commercial, Industrial, Residential
FREE CATALOG. Write Dept. CE

ROBOT APPLIANCES, INC.
15165 Prospect—Dearborn, Mich.

MAINTENANCE OF FLOAT BATTERIES

[FROM PAGE 101]

proper float voltage and current. Recommended voltage is 2.15 volts per cell at 77°F. Recommended float current is approximately 0.05% of the 8 hour rate of discharge. After a battery has been discharged, the charging rate must be increased to bring the battery back to a fully charged condition. Some types of charging equipment do this automatically, other types must be adjusted to deliver increased current.

2. Keep batteries clean, particularly the cover, so that an accumulation of dirt or moisture will not cause short circuits. Wiping battery monthly with a cloth generally is sufficient to keep them clean.

3. Check water levels monthly and add water when the electrolyte level drops below the level line. In this connection, only distilled water should be used.

4. Record voltage and specific gravity readings of each cell when making the monthly check. Also record the temperature of a pilot cell and correct specific gravity readings for temperature. For each 3° above 77°F, add 0.001 point in specific gravity. For each 3° below 77°F, subtract 0.001 point. These corrections are necessary in order to make valid comparisons of records from month to month. If readings indicate that all cells are low, the battery is not receiving sufficient charge. If individual cells are low, an equalizing charge should be given.

5. When giving an equalizing charge, gradually raise the charging voltage to 2.35 volts per cell. Continue to float at this voltage until there is no increase in pilot cell specific gravity for 24 hours after current to the battery has tapered to a constant value.

6. To determine whether the battery will deliver rated capacity, give it a discharge test. This test is given by first fully charging the battery and then discharging it at a standard catalogued discharge rate. The test should be discontinued at one-half the time catalogued to fully discharge the battery. This will leave a reserve should an emergency occur before the battery is recharged. Record the battery voltage at the end of the test. Compare it with the corresponding value given on manufacturer's curves.

7. The records which are made during monthly maintenance checks—from the initial charge throughout the life of the battery—should be filed.

SEARCHLIGHT SECTION

(Classified Advertising)

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EQUIPMENT USED OR RESALE

UNDISPLAYED

\$1.50 per line, minimum 3 lines. To figure advance payment add 5% above rate as a line. Position Wanted and Unpublished Advertising unpreserved rate is one-half of above rate, payable in advance.

See advertisement in care of our New York, Chicago & San Francisco offices, counts as one additional line.

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SAN FRANCISCO: 68 Post St. (4)

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6000—S-2 wire for conduit line.
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1—Metal Junction box 20" x 20".
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FOR SALE

8 New 500 Watt No. 960 Century Down-lites Complete with Lamps, and Cutoff Rings.

C. G. HOLLAND
57 GLADSTONE ST. PROVIDENCE (5), R. I.

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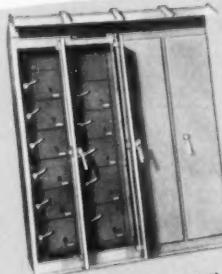


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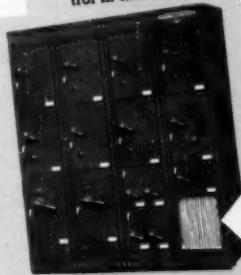
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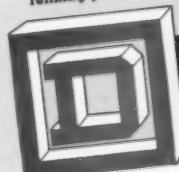
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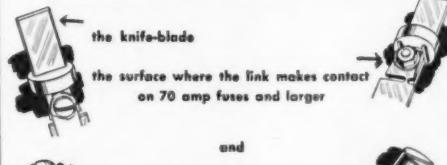
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